

The University of Chicago

SOME FOSSIL PLANT TYPES OF ILLINOIS

A RESTUDY OF THE LESQUEREUX TYPES IN THE WORTHEN
COLLECTION OF THE ILLINOIS STATE MUSEUM, AUGMENTED
BY DESCRIPTIONS OF NEW SPECIES FROM MAZON CREEK

A DISSERTATION SUBMITTED TO THE
FACULTY OF THE DIVISION OF THE
PHYSICAL SCIENCES IN CANDIDACY FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOLOGY AND PALEONTOLOGY

1939

By

RAYMOND E. JANSSEN

Private Edition, Distributed by
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Reprinted from
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of New Species From Mazon Creek.*

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Acknowledgment is expressed to the late Dr. Adolph C. Noé of the University of Chicago, to whom I am indebted for the assignment of this study, and for advice and criticism throughout the progress of the work. His untimely death occurred as this monograph was being completed. I am also indebted to Dr. Thorne Deuel, Chief of the Illinois State Museum, Springfield, for the use of the type specimens in the collections of the Museum; and to George Langford, Sr., and George Langford, Jr., of Joliet, Illinois, who collected and presented to the Illinois State Museum for the purpose of this study the new species and varieties of plant fossils herein described. I also wish to express my appreciation for the valuable criticism and suggestions rendered by Dr. James M. Schopf of the Illinois State Geological Survey.

RAYMOND E. JANSSEN

Chicago, April 22, 1939.

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INTRODUCTION

Paleobotany, as a science, had its inception in Illinois under the leadership of Leo Lesquereux, who had been engaged, as a member of the first geological survey of the State, to make studies of the coal deposits and fossil plant remains. Lesquereux was one of the foremost paleobotanists of his time. The work which he accomplished, not only in Illinois, but in various other states, has become monumental in its scope. The Geological Survey of Illinois was first established by legislative enactment in 1851. Not until 1866, however, did the first reports appear in published form under the directorship of A. H. Worthen. The first descriptions of Illinois plant fossils, resulting from the work of Lesquereux, were contained in Volumes II and IV of the Survey reports, dated 1866 and 1870, respectively. Included in these descriptions were 109 new species established by Lesquereux upon specimens collected from various localities and horizons within the state. All were of Carboniferous age.

According to law, the specimens collected by the original Survey were first deposited with the Secretary of State at Springfield, and later were housed in the Illinois State Museum. During subsequent years, overcrowded conditions in the Museum required the storage of many of the collections with the result that many of the specimens were lost to view. Moves into new locations during the passing of the years also tended further to obscure the material.

Early in 1938 it was decided to take from storage much of this material, with the result that Lesquereux's early specimens were again brought to light. In the meantime much had transpired in the field of paleobotany. Our understanding of many forms had been increased by subsequent fossil discoveries, reclassifications in taxonomy had been made by various workers both in the United States and abroad, and improved methods of describing and illustrating specimens had been instituted. Consequently, it was deemed advisable, upon the suggestion of the late Dr. A. C. Noé of the University

of Chicago, to make a restudy of Lesquereux's type specimens which had thus again come to attention.

The purpose of such an investigation was to determine, in the light of present-day knowledge, the validity of the new species established by Lesquereux upon the Illinois specimens, to revise their taxonomic classifications where necessary, and to ascertain which, if any, might be referable to previously known species. The value of such a study is twofold. It places the taxonomic classifications of the species upon a modern basis, and the publication of accompanying photographic illustrations acquaints present paleobotanical workers with type specimens known to them heretofore only by the drawings contained in the early Survey reports.

It was first planned to include in this study all of the new species established by Lesquereux in Volumes II and IV of the Report of the Geological Survey of Illinois. A search of the State Museum's collections, however, failed to reveal many of the type specimens, only 59 of the 109 species being located. From the Museum accession catalogue, it would appear that the most of these were never deposited in the institution. It is possible that some of the specimens which Lesquereux described may have been privately owned and subsequently reverted to their original owners. Others may have been deposited elsewhere without ever having become a part of the State collection.

The impossibility of locating all the type specimens made the original plan infeasible. Consequently, it was decided to limit the study to only those types which are in the Illinois State Museum. The results of this study constitute Part I of this monograph.

For the first time each specimen has been photographed, thereby showing the precise characteristics of the respective forms. Some of the photographs admittedly are very poor illustrations, such being the case when the type specimens themselves were so poor as to be incapable of better reproduction. In a few cases, also, the specimens seem to have suffered from the ravages of time so that pertinent characters are partially effaced, or portions of the original specimen have become broken off and lost.

The value of photographic illustrations as against line drawings of the specimens cannot be over-emphasized. In spite of the great care with which many of the early drawings were doubtless made, the human tendency to over-emphasize some details, to minimize

others, or to vary the widths and pressures of the pen strokes, all tend to present at times a finished picture which is not perfectly in accord with the original specimen from which it was copied. In many instances the line drawings were made in reduced or enlarged size without the scale being indicated. The photographs made for this study show all the specimens in natural size, except where otherwise indicated by the appropriate scale. Such exceptions were made only when absolutely necessary in order to show the complete specimen on a single plate.

Tabulated results of the present study furnish interesting figures. Of the 59 species studied, only 18 specific names remain as valid names today. Twenty-six were found to be referable to previously established species, 2 had been specifically renamed, and 13 were so poorly preserved as to be valueless as specific types. Of the 18 which remain as valid species, 10 have been referred to genera different from those in which they were originally included. Among the 26 species which were found to be referable to previously known species, 12 are now placed under generic classifications differing from those in which they were originally included.

It should be stated that these changes were not effected solely as a result of the present study. The validity of some of Lesquereux's species had been questioned by various workers during the intervening years, and in some cases revisions were made formally. For the most part, such changes were made without the respective authors having had the opportunity of examining the type specimens, their judgments being guided solely by the original descriptions and line drawings. In the present study, some of these revisions have been accepted, and others rejected. In some cases, Lesquereux himself revised his original classifications in later publications. References to all such changes, revisions, or objections have been included in the synonymy lists and discussions pertaining to the consideration of the respective species.

The question naturally arises as to why many of Lesquereux's Illinois types are no longer valid. Most of these changes were required because the respective forms had been previously described by earlier paleobotanists, thereby constituting priority over Lesquereux's species. At this late date, we can only conjecture as to the causes for this situation. Perhaps Lesquereux did not have access at one time or another to some of the previous literature. Very many

changes, however, have been predicated on a more complete knowledge of various forms, made and recorded by workers during the intervening years. As a result of such works, many specimens which were once considered to represent distinct species are now known definitely to be merely different parts of the same plant or to represent differing modes of preservation of an identical form.

At least thirteen of Lesquereux's "new" species were based on material which was so fragmentary or poorly preserved as to be valueless for specific determination. Because such specimens could not be definitely assigned to species known to him, Lesquereux preferred to give them specific status even though they lacked the necessary characteristics for specific differentiation. As a result of the present study, such specimens have been relegated from specific status to mere generic reference. Such action is in line with modern trends of ridding the science of useless appurtenances.

The synonymy accompanying the consideration of the respective forms herein considered is complete, insofar as known, as regards the new names established by Lesquereux. In cases where a Lesquereux species is declared invalid and is consequently referred to a previously known species, only original references, plus pertinent and catalogue references, to the prior species are given. For example, *Lepidodendron tijoui* Lesquereux has been referred to *L. rimosum* Sternberg. In this case, all known references to *L. tijoui* are given in the synonymy, but only those referring to the earliest descriptions and subsequent catalogue lists of *L. rimosum* are included. To include every known reference of such commonly known species as *L. rimosum* would become burdensome and would unnecessarily lengthen the monograph. Complete synonymies in such cases may be consulted by the reader in the *Fossilium Catalogus* and other standard works which have here been cited.

In cases demanding the determination of priority concerning specific names, the International Rules of Botanical Nomenclature, as revised by the International Congress of Cambridge, 1930,¹ have been followed. It should be recalled that priority in the field of paleobotany begins with the year 1820. Names used before that time may be valid, however, if they were continued in use during, or after, that year without first having been superseded. In such

¹ J. Briquet, 1935.

cases the original author of the specific name has been credited in quoting the authority.

Names of publications are given in abbreviated form in the footnotes and synonymy lists. These may be found in full in the bibliography by reference to the authors and dates of the respective works. No quotations have been accepted "on faith" from other publications; in all cases the original source has been consulted, and the original reference cited. In this respect the writer has been fortunate in having been able to obtain, through the University of Chicago Libraries, the John Crerar Library, the library of the United States Geological Survey, and of the Smithsonian Institution, the use of original volumes or authoritative copies or reprints of all the references pertinent to the present study.

It is hoped that the study will be of value to those workers who have cause to consult Lesquereux's studies of Illinois plant fossils. The photographs of the type specimens should be useful where comparisons with the original types are desirable and when access to the specimens themselves is not possible or convenient.

Part II of the present monograph is devoted to the descriptions of ten new species and varieties of fossil plant impressions which have recently been discovered in the Mazon Creek region. The specimens were collected by George Langford, Sr. and George Langford, Jr., of Joliet, Illinois, whose interest in paleobotany has extended over a period of many years. Their collection of Mazon Creek material, which is one of the finest in existence, numbers about 50,000 specimens. The collectors have permitted the writer to select from their collection the specimens herein established as new types, whereupon these have been presented as a permanent gift to the Illinois State Museum. All of these specimens were collected from the strip mine of the Northern Illinois Coal Corporation, located in Wilmington and Custer townships in the southwestern part of Will County, Illinois, and situated along U. S. Highway 66, approximately midway between the towns of Wilmington and Braidwood. This locality constitutes an extension of the famous Mazon Creek region.

The specimens have been compared with the illustrations and descriptions in all available publications dealing with Carboniferous paleobotany. Having failed to correspond in character with any known previously described forms, they are considered to be new species or varieties, and are so described.

PART I

A RESTUDY OF THE LESQUEREUX
TYPES IN THE WORTHEN COL-
LECTION OF THE ILLINOIS
STATE MUSEUM

PART I

A RESTUDY OF THE LESQUEREUX TYPES IN THE WORTHEN COLLECTION OF THE ILLINOIS STATE MUSEUM

Descriptions of Species

ANNULARIA Sternberg (1823)

(Versuch der Flora der Vorwelt, Vol. 1, fasc. 2, p. 32)

ANNULARIA STELLATA Martin

(ANNULARIA INFLATA Lesquereux)

Plate I, fig. 1

1804. ——— Schlotheim, Flora der Vorwelt, pl. 1, fig. 4.
1809. *Phytolithus stellatus* Martin (pars), Petrificata Derbiensia, pl. 20, figs. 4, 5?, 6.
1820. *Casuarinites stellatus* Schlotheim, Petrefactenkunde, p. 397 (with reference to Flora der Vorwelt, 1804, pl. 1, fig. 4).
1823. *Annularia spinulosa* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 2, p. 31, pl. 19, figs. 4, 5?; addenda, p. 36; tentamen, p. XXXI.
1825. *Annularia fertilis* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 4, p. 43, pl. 51, fig. 2; tentamen, p. XXXI.
1825. *Bornia stellata* Sternberg. Versuch der Flora der Vorwelt, Vol. I, tentamen, p. XXVIII.
1828. *Annularia longifolia* Brongniart, Prodrome, p. 156.
1834. *Asterophyllites equisetiformis* (Schlotheim) Brongniart. Lindley & Hutton, Fossil Flora, Vol. II, pl. 124.
1860. *Annularia stellata* (Schlotheim) Wood, Proc. Acad. Natural Sciences of Philadelphia, Vol. XII, p. 236.
1869. *Annularia longifolia* Brongniart. Schimper, Traité de Paléont. Végétale, Vol. 1, p. 348, pl. 22, fig. 5; pl. 26, figs. 2-4.
1870. *Annularia inflata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 423, pl. 20, figs. 1-2.
1874. *Annularia inflata* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 459.
- 1879-80. *Annularia inflata* Lesquereux, Coal Flora of Penn., Vol. I, p. 47, pl. 2, figs. 2-2bb.
1886. *Annularia stellata* Schlotheim. Kidston, Catalogue of Paleozoic Plants in the British Museum, p. 45.

1889. *Annularia inflata* Lesquereux. Miller, North American Geology and Paleontology, p. 106.
1899. *Annularia stellata* (Schlotheim) Wood. White, U. S. G. S. Monograph 37, p. 159, pl. 24, fig. 3b.
1914. *Annularia inflata* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 2, p. 16.
1924. *Annularia stellata* Schlotheim. Jongmans, Fossilium Catalogus, Vol. II, Part 11, p. 751.

Original Description of *Annularia inflata* Lesquereux:

The essential difference which separates this species from *A. longifolia* Brongniart, consists in the form of the leaflets, which are oblanceolate, obtuse, subcylindrical or inflated upwards without trace of medial nerve, or with merely an obscure line indicating a central vessel, while the leaflets of *A. longifolia* are flat, with recurved borders and marked by a thick, flat, medial nerve. The stem of this species does not appear as thick as in *A. longifolia*, and the branches come out in opposite direction from the middle of the whorls, or rather from above them, than from below. Mazon Creek, Illinois.

In his general discussion of the species, Lesquereux further states:

It may be that we have here two parts of the same species, one representing branches growing out of or above water under atmospheric influences, with dry, flat leaflets, *A. longifolia*; the other representing the floating part, sustained in water by bladderly-inflated leaflets, as shown in our species. But if it is so, it is peculiar that this, so different a form of a common species, has not been found elsewhere and described before.

Discussion:

In order to evaluate Lesquereux's description of *A. inflata*, we must refer back to *A. longifolia* Brongniart. This species was established by Brongniart in his Prodrôme, 1828, page 156. He wrote no description, merely establishing a new name, and giving as synonyms, *Casuarinites stellatus* Schlotheim, and *Bornia stellata* Sternberg. Obviously, then, *A. longifolia* represents only a new specific name which was intended to replace previously established names.

Schlotheim's original description of *Casuarinites stellatus* is translated as follows:

Distinguished by numerous long leaves and many widely separated nodes, from which the leaves diverge star-like. Sometimes the leaves attain a length of nearly three inches. It appears that two varieties are present from which a proper species could be made, the one with fine and small leaves, the other with dissimilar wider leaves.¹

No description was given for the genus which, as far as known, was established at the same time.

¹ Schlotheim, 1820, p. 397.

Sternberg's original description of *Bornia stellata* is translated simply as: "Stem branching, grooved, in ramose whorls; leaves numerous, linear; internodes twice the length of the shorter leaves."¹ *Casuarinites stellatus* is here given as a synonym of *Bornia stellata*, and it is evident that the author considered them as equivalent forms, placing the species *stellatus* into his new genus *Bornia*.

The distinction between the genera *Casuarinites*, *Asterophyllites*, *Schlotheimia*, *Bornia*, and *Annularia*, as originally defined by their respective authors is not clear, and it is questionable whether even they fully understood each other's classifications. Subsequent authors seem to have favored the retention of *Annularia* and *Asterophyllites* as representing two generic forms of Calamite foliage.

In this respect, Lesquereux's type specimen of *Annularia inflata* properly belongs to the genus *Annularia*. An examination of the specimen indicates that it does not constitute a distinct species, but should be referred to *A. stellata*. Without even having seen the type specimen of *A. inflata*, Schimper² notes its similarity to *A. longifolia*, and Jongmans³ notes its similarity to *A. stellata*.

It is of further interest to note that although Schlotheim has always been credited as the author of the specific name, *stellatus*, it was first used by Martin in 1809,⁴ at which time he pictured this fossil under the name *Phytolithus stellatus*, and described it as follows: "A fossil vegetable. Original a plant. Stem simple, round, slightly striated in a longitudinal direction. Leaves whorled, linear, entire, about twelve or fourteen in each whorl. The whorls numerous, but distant." The specific name was apparently accepted by Schlotheim without reference to Martin's work, and later workers have consequently credited Schlotheim. The fossil was previously pictured by Schlotheim in 1804, but was not named at that time.

When describing his specimen, Lesquereux admitted the possibility of its relationship to *A. longifolia* which, as we have seen, is considered to be a synonym of *A. stellata*. The leaves of Lesquereux's specimen have the general shape of those of *A. stellata*, but he misinterpreted their cross-section, thinking that they were inflated bladders rather than arched leaves. The faintness of the midribs was also misconstrued by Lesquereux, for actually this is

¹ Sternberg, 1825, p. XXVIII.

² Schimper, 1874, p. 459.

³ Jongmans, 1914, p. 16.

⁴ Martin, 1809, pl. 20.

merely a phenomenon of preservation. The specimen should not have been described as lacking midribs in the leaves.

Conclusion:

It is concluded that *Annularia inflata* Lesquereux was founded on erroneous characteristics, that the name should be discarded as a valid specific name, and that the specimen should be referred to the species *Annularia stellata* Martin.

SPHENOPHYLLUM Brongniart (1828)

(Prodrome d'une Histoire des Végétaux Fossiles, p. 68)

SPHENOPHYLLUM CORNUTUM Lesquereux

Plate I, fig. 2b

- 1870. *Sphenophyllum cornutum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 421, pl. 19, figs. 1-5.
- 1879-80. *Sphenophyllum cornutum* Lesquereux, Coal Flora of Penn., Vol. I, p. 56, pl. 56, figs. 5-5b.
- 1884. *Sphenophyllum cornutum* Lesquereux, Thirteenth Ann. Report Indiana Dept. Geol. and Nat. Hist., Vol. II, p. 46.
- 1936. *Sphenophyllum cornutum* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 21, p. 1090.

Original Description of *Sphenophyllum cornutum* Lesquereux:

Main stem round, half an inch broad, articulate at equal distances (about one inch), inflated at the nodes, smooth but obscurely ribbed in length, divided about at right angles by long straight branches bearing whorls of 5-6 leaflets, joined at the base; leaflets equal, fan-like in outline, broadly cuneiform to the base, divided from below the middle into 7-9 linear, pointed, nearly equal lobes; veins distinct, flat, 4-5 at the base of each leaflet, forking once, each division ascending to the top of one of the lobes. Colchester, Illinois.

Discussion:

For a better examination of the type specimen, additional fragments of matrix which had been obscuring the leaf bases were removed with a knife blade. It was thus discovered that Lesquereux had erred in his assumption that 4-5 veins entered the base of each leaf. The species should have been described as having two veins entering the base of each leaf, both of which bifurcate twice so that a single veinlet extends to the tip of each lobe. On each leaf there are eight linear, pointed, nearly equal lobes. The number of leaves per whorl cannot be determined. Although closely related to *Sphenophyllum cuneifolium* Sternberg, the species differs essentially in having two veins entering the base of the leaf instead of only one,

eight lobes instead of four, and clefts extending down beyond the middle of the leaf.

It should be noted that Weiss¹ and Jongmans² have suggested a similarity of the species to *Cingularia* Weiss. In this respect they were guided by the inaccurate description and illustrations of Lesquereux, not having had the opportunity of examining the type specimen itself. The specimen is not a fructification, and therefore should not be referred to *Cingularia*.

Conclusion:

It is concluded that *Sphenophyllum cornutum* Lesquereux is a distinct form, and should stand as a valid species under the corrected description as discussed above.

LEPIDODENDRON Sternberg (1820)

(Versuch der Flora der Vorwelt, Vol. I, fasc. 1, p. 23)

LEPIDODENDRON WORTHENI Lesquereux

Plate I, figs. 3-4

- 1866. *Lepidodendron wortheni* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 452, pl. 44, figs. 4-5.
- 1870. *Lepidodendron wortheni* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. II, p. 28.
- 1879-80. *Lepidodendron wortheni* Lesquereux, Coal Flora of Penn., Vol. II, p. 388, pl. 64, figs. 8-9.
- 1886-88. *Lepidodendron wortheni* Lesquereux. Zeiller, Valenciennes, p. 467, pl. 71, figs. 1-3.
- 1904. *Lepidodendron wortheni* Lesquereux. Fischer, Abhandl. K. Preuss. Geol. Landesanst., N. F. No. 39, p. 69.
- 1906. *Lepidodendron wortheni* Lesquereux. Fischer in Potonié, Abbild. und Beschreib. foss. Pflanz., Part 4, No. 77.
- 1909. *Lepidodendron wortheni* Lesquereux. Arber, Fossil Plants, p. 10.
- 1910. *Lepidodendron wortheni* Lesquereux. Renier, Documents Paleont. Terr. Houiller, pl. 7.
- 1925. *Lepidodendron wortheni* Lesquereux. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 8, fig. 2.
- 1928. *Lepidodendron wortheni* Lesquereux. Jongmans, Stratigraphie van het Karboon in het Algemeen en van Limburg in het Bijzonder, p. 21, pl. 13.
- 1929-36. *Lepidodendron wortheni* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 370; Part 21, p. 1038.
- 1938. *Lepidodendron wortheni* Lesquereux. Bell, Fossil Flora of Sydney Coalfield, Nova Scotia, p. 94, pl. 96, figs. 4-7.
- 1939. *Lepidodendron wortheni* Lesquereux. Janssen, Leaves and Stems from Fossil Forests, p. 43, fig. 19.

¹ Weiss, 1876, p. 97.

² Jongmans, 1911, pp. 361, 372.

Original Description of *Lepidodendron wortheni* Lesquereux:

Stem slender; cicatrices oblanceolate, narrowed and continuous at the base, transversely much wrinkled, bordered with a narrow, smooth margin. Vascular scars as broad as the cicatrices, acute at both sides, emarginate above, very obtuse, arched in the lower part, marked in the middle by three equal small points, and overtopped by a pointed crown; tubercles none, appendages marginal. Coal No. 1B, Murphysboro, Illinois.

Discussion:

The type specimen consists of a small fragment of laminated shale upon which are impressed three sets of bark pattern—two on one side, and one on the other. The shale is slightly folded so that the impression on one side appears to have been slightly stretched, whereas that on the opposite side is slightly compressed. This apparent variation in the species is, in all probability, due to the mode of preservation. The description, as given by Lesquereux, agrees essentially with the specimen, and covers all observable details. Because of the fragmentary nature of the specimen, the stem proportions cannot be ascertained. Lesquereux's reason for describing the stem as being "slender" is a cause for speculation. The species has been found in various localities in the United States and Europe, and has been recognized by numerous workers in paleobotany.

Conclusion:

It is concluded that *Lepidodendron wortheni* Lesquereux is a distinct form, and should stand as a valid species.

LEPIDODENDRON VOLKMANNIANUM Sternberg

(LEPIDODENDRON COSTATUM Lesquereux)

(LEPIDOPHLOIOS PROTUBERANS Lesquereux)

Plate II; Plate III, fig. 1

- 1825. *Lepidodendron volkmannianum* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 4, pp. X, 44, pl. 53, figs. 3-3c.
- 1866. *Lepidodendron costatum* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 453, pl. 44, fig. 7.
- 1870. *Lepidophloios protuberans* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 440, pl. 26, figs. 1-2.
- 1874. *Lepidophloios protuberans* Lesquereux. Schimper, Traité de Paléont. Végét., Vol. III, p. 537.
- 1875-77. *Lepidodendron volkmannianum* Sternberg. Stur, Die Culm-Flora, p. 79, pl. 18 (35), fig. 4; pl. 23 (40), fig. 2.
- 1879-80. *Lepidodendron costatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 381, pl. 64, fig. 4.

- 1879-80. *Lepidophloios protuberans* Lesquereux, Coal Flora of Penn., Vol. II, p. 425, pl. 67, figs. 9-9a.
1899. *Lepidodendron volkmannianum* Sternberg. Hoffman & Ryba, Leitpflanzen palaeozoischen Steink. Mittel-Europa, p. 81, pl. 15, figs. 4-6.
1904. *Lepidodendron costatum* Lesquereux. Fischer, Abhandl. K. Preuss. Geol. Landes., N. F. 39, p. 39.
1904. *Lepidodendron costatum* Lesquereux. Koehne, Abhandl. K. Preuss. Geol. Landes., N. F. 43, p. 71.
1925. *Lepidophloios protuberans* Lesquereux. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 8, fig. 1.
1927. *Lepidodendron volkmannianum* Sternberg. Hirmer, Handbuch der Paläobotanik, p. 201, figs. 224-225.
1929. *Lepidodendron costatum* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 142.
1929. *Lepidodendron volkmannianum* Sternberg. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 364.
1930. *Lepidophloios protuberans* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 441.
1939. *Lepidophloios protuberans* Lesquereux. Janssen, Leaves and Stems from Fossil Forests, p. 49, fig. 27.

Original Description of *Lepidodendron costatum* Lesquereux:

Cicatrices scarcely marked, if at all; apparently oval, wrinkled, flat, separated by a rugose half an inch broad, straight contiguous margin, resembling the intermediate ribs of a *Sigillaria*. Vascular scars deeply and broadly notched above, arched below, angular on the sides, marked in the middle by two large external points, and a smaller medial one; appendages long and well marked; crown a large oval point. Chester group, Pope County, Illinois.

Original Description of *Lepidophloios protuberans* Lesquereux:

Stem arborescent with cicatrices somewhat distant, separated by thin, undulating, contiguous wrinkles bordering the cauda; cicatrices double; the upper part or leaf scar is rounded upwards and downwards, obtusely acute on both enlarged sides, marked by three vascular points, the middle of which is capped by a small, half round dot; the lower part like a broadly oval-rhomboidal wing, has both sides curving downwards as a prolongation of the borders of the leaf scar, and abruptly bent into a long pointed cauda. The wing is marked above the middle and under the leaf scar by a semi-lunar upraised scar. The cicatrices are generally deeply immersed in the stone, and their outlines rarely discernable. They are often covered with a coat of thick carbonaceous matter, and their center marked by a prominent nose-like gibbosity. Morris, Illinois.

Discussion:

The description of *Lepidodendron costatum* does not agree in all details with the type specimen itself. The furrows are not characterized by a straight contiguous margin as stated, but actually are represented only by a very rugose area occupying the entire space between the cicatrices. Although this feature is clearly indicated on Lesquereux's original illustration, the type specimen does not show it.

It would seem that this feature must have been incorporated erroneously into the drawing. The same illustration is repeated in the Coal Flora of Pennsylvania. The figure also shows the upper part of the vascular scar to be more deeply notched than is actually the case on the specimen itself. In this respect, the description of *L. costatum* more nearly resembles the figured illustration of *Sigillaria reticulata* Lesquereux shown in plate III, fig. 2 of the Second Report of the Geological Reconnaissance of Arkansas, 1860. It is not certain that the two are identical, however, as the type specimen of *L. costatum* has the vascular scars terminated laterally in more acute angles, and these are extended downward for a short distance (as is characteristic of most *Lepidodendrons*) before merging with the longitudinal wrinkles.

In discussing this species in his Coal Flora of Pennsylvania (p. 382), Lesquereux states that were it not for the distinctly striate ribs, the specimen might be referable to *Lepidodendron veltheimianum* Sternberg. On the basis of this characteristic, both Fischer¹ and Koehne² have referred it to *Sigillaria*. As already pointed out, this feature does not actually exist on the type specimen. On the contrary, it is almost identical in nature with specimens figured by Stur³ in his Culm-Flora, and by Hirmer⁴ in his Handbuch. These are considered to be variations in the lower and older portions of the trunk of *Lepidodendron volkmannianum* Sternberg.

In like manner, the specimen named *Lepidophloios protuberans* by Lesquereux is considered to be the decorticated portion of the lower trunk of *Lepidodendron volkmannianum*. Since it is decorticated, its characters are much less distinct than those of the foregoing specimen. Its scars are situated somewhat closer together, but such differences might be expected on different parts of the same tree or between individual trees.

Conclusion:

It is concluded that *Lepidodendron costatum* and *Lepidophloios protuberans*, both of Lesquereux, do not represent distinct species, but are forms of *Lepidodendron volkmannianum* Sternberg. The type specimens of both are referred to the latter species, and the names given them by Lesquereux are declared invalid.

¹ Fischer, 1904, p. 39.

² Koehne, 1904, p. 71.

³ Stur, 1877, pl. 18(35), fig. 4; pl. 23(40), fig. 2.

⁴ Hirmer, 1927, p. 196, figs. 224-225.

LEPIDODENDRON RIMOSUM Sternberg
 (LEPIDODENDRON TIJOU Lesquereux)
 (ULODENDRON ELONGATUM Lesquereux)

Plate III, fig. 2; Plate IV

1809. *Phytolithus (cancellatus)* Martin, Petrificata Derbiensia, pl. 13, fig. 3.
 1820-25. *Lepidodendron rimosum* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 1, pp. 21, 23, pl. 10, fig. 1; fasc. 4, p. XI.
 1828. *Lepidodendron rimosum* Sternberg. Brongniart, Prodrôme; p. 86.
 1870. *Lepidodendron tijoui* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 431, pl. 24, figs. 1-3b.
 1870. *Ulodendron elongatum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 437, pl. 23, fig. 4.
 1874. *Lepidodendron tijoui* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 535.
 1874. *Ulodendron elongatum* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 536.
 1879-80. *Ulodendron elongatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 405, pl. 65, fig. 1.
 1880. *Lepidodendron tijoui* Lesquereux, Coal Flora of Penn., Vol. II, p. 391.
 1883-84. *Ulodendron elongatum* Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 85, pl. 18, fig. 2.
 1904. *Lepidodendron tijoui* Lesquereux. Fischer, Abhandl. K. Preuss. Geol. Landes., N. F. 39, p. 66.
 1906. *Lepidodendron rimosum* Sternberg. Fischer in Potonié, Abbild. und Beschreib. foss. Pflanz., Part 4, No. 74.
 1906. *Lepidodendron serpentigerum* König. Fischer in Potonié, Abbild. und Beschreib. foss. Pflanz., Part 4, No. 75, p. 2 (syn. only).
 1913. *Ulodendron elongatum* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 1, p. 35.
 1929. *Lepidodendron rimosum* Sternberg. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 273.
 1929. *Lepidodendron tijoui* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 324.

Original Description of *Lepidodendron tijoui* Lesquereux:

Cicatrices of the cortex proportionately small, ovate, long pointed at both ends, separated by a flat irregularly wrinkled border, about one line broad; leaf scar large, placed above the middle, smooth, marked by its three vascular points, without medial line or appendages; cicatrices of the decorticated surface of the same form, smooth, merely marked in the middle by a vertical line. St. Johns, Illinois.

Original Description of *Ulodendron elongatum* Lesquereux:

The cicatrices of the surface are in this species about of the same form as those of *Lepidodendron rimosum* Sternberg, or of *Lepidodendron simplex* Lesquereux. They differ only by a narrow, elevated round border, which, as they are slightly apart from each other, leaves between them a narrow smooth furrow. The leaf scar is nearly central, and shows the three vascular points

of a *Lepidodendron*. The strobile-scars are proportionately longer and narrower than in the former species, nearly twice as long as broad, vertically distant eight inches or more.

As I have not seen any specimens with double rows of these scars, I do not know at what distance they are placed horizontally, and whether they are alternate or opposite. From the form of its cicatrices, this species might be identical with our *Lepidodendron simplex*, and the strobile scars represent the base of a cone like *Lepidostrobus princeps* Lesquereux. Both species also may be referable to *Lepidodendron rimosum* Sternberg, and *Lepidostrobus variabilis* Lindley & Hutton, which Prof. Geinitz, in his *Verst.*, p. 35, describes as the same. It is only remarkable that this celebrated author persists in considering these enormous cones as sustained at the end of small branches which, according to his description, are only one-third of an inch in thickness, and that he admits the round scars of cones as mere branch scars. Roof shale, Morris, Illinois.

Discussion:

In all essential particulars, the description of *Lepidodendron tijoui* Lesquereux agrees with that of *Lepidodendron rimosum* Sternberg. The original description of the latter is translated as follows: "Stem arborescent, cortex between the distant cushions wrinkled; scars lanceolate at both ends, diminishing, naked; leaf scars under the shield transversely rhomboidal and somewhat obliterated."¹

Lesquereux's specimen is quite similar to Sternberg's drawing of *L. rimosum* with the exceptions that the leaf scars of the former are a trifle smaller, are more closely arranged, and have the wrinkles of the cortex between the scars more densely compacted. Such differences within a species might obtain if the two specimens originally came from trees of different ages or from different parts of the respective trees. Lateral pressure or tension at the time of burial and preservation of the specimens could also cause such variance. Jongmans² has already pointed out the similarity between the two forms, and suggests that they may both represent the same species. In contrast, Fischer³ considers *L. tijoui* to be referable to *L. serpenterum* König. A careful inspection of the type specimen, however, suggests a much closer affinity to *L. rimosum* Sternberg. In his leaflet on *L. rimosum*, Fischer⁴ pictures specimens which indicate a rather wide range in the variability of the species. The smaller forms have the leaf scars more closely situated in relation to each other, and the wrinkled cortex is correspondingly narrower and more compact between them. Lesquereux's specimen seems to be intermedi-

¹ Sternberg, 1820, p. 21.

² Jongmans, 1929, p. 324.

³ Fischer, 1904, p. 66; in Potonié, 1906, Vol. IV, No. 75.

⁴ Fischer in Potonié, 1906, Vol. IV, No. 74.

ate in size and relative separation of the leaf scars between the smallest and largest forms of *L. rimosum*.

In regard to *Ulodendron elongatum*, Lesquereux has admitted the resemblance of the leaf scars to those of *Lepidodendron rimosum* Sternberg, but in so doing states that the cortex between the scars is smooth. If this were truly the case, the specimen would be comparable rather with *L. veltheimianum* Sternberg. An examination of the specimen discloses that the cortex is certainly wrinkled, and consequently is referable to *L. rimosum*.

The presence of a large *Ulodendron* scar on the specimen raises the question as to whether it should be referred to the genus *Ulodendron* or to *Lepidodendron*. A decision would seem to be somewhat arbitrary inasmuch as one is dealing here with two form-genera, both of which are existant upon a single specimen. Consequently, it seems advisable to limit the use of *Ulodendron* to specimens in which the branch scars are predominant and in which the leaf scar pattern is not specifically recognizable. Since the leaf scars of the specimen here under consideration are specifically determinable, the specimen should be referred to *Lepidodendron*.

Conclusion:

It is concluded that *Lepidodendron tijoui* Lesquereux does not represent a distinct species, but that it is an intermediate form of *Lepidodendron rimosum* Sternberg. It is also concluded that *Ulodendron elongatum* Lesquereux does not represent a distinct species, but is a ulodendron condition of *Lepidodendron rimosum*. Consequently the names of both specimens should be discarded as invalid, and the specimens referred to *Lepidodendron rimosum* Sternberg.

LEPIDODENDRON sp.

(LYCOPODITES ANNULARIAEFOLIUS Lesquereux)

Plate III, fig. 4

- 1870. *Lycopodites annulariaefolius* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 426, pl. 21, fig. 5.
- 1874. *Lycopodites annulariaefolius* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 532.
- 1879-80. *Lycopodites annulariaefolius* Lesquereux, Coal Flora of Penn., Vol. II, p. 361.
- 1930. *Lycopodites annulariaefolius* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 543.

Original Description of *Lycopodites annulariaefolius* Lesquereux:

Stem round, dichotomous, bearing opposite leaves, apparently united by two at the base, half embracing and slightly decurrent; leaves linear-lanceolate, obtusely pointed, slightly narrowed to the base, marked with a medial nerve, disappearing above the middle, open or slightly reflexed. Mazon Creek, Illinois.

Discussion:

In discussing this specimen, Lesquereux states, "It is not quite evident that the leaves are approached by pairs, and placed in two parallel rows or distichous." An examination of the type specimen, which is rather poorly preserved, indicates that it should not have been described as possessing opposite leaves. It is more likely that the leaves were spirally arranged, and that as a result of loss of numerous leaves, the remainder appear to be more or less opposite to each other. Actually, several of them are not directly opposite. The specimen, as a whole, bears a close resemblance to the twig of *Lepidodendron lanceolatum* Lesquereux as pictured in the Coal Flora of Pennsylvania, Plate 63, fig. 4. However, the scar pattern of the specimen is not discernable, and consequently cannot be definitely assigned to this species. It is doubtless a twig of *Lepidodendron*. In this connection, it is interesting to note that Schimper¹ considered it to be a *Lepidodendron* twig although he had no opportunity to examine the actual specimen.

Conclusion:

It is concluded that *Lycopodites annulariaefolius* Lesquereux does not constitute a valid species, and that the specimen should be referred to *Lepidodendron* sp. Since the scar pattern of the stem cannot be ascertained, it cannot be determined specifically.

LEPIDOPHLOIOS Sternberg (1825)

(Versuch der Flora der Vorwelt, Vol. I, tentamen, p. X)

LEPIDOPHLOIOS LARICINUS Sternberg

(LEPIDOPHLOYOS OBCORDATUM Lesquereux [pars])

Plate III, fig. 3

1820. *Lepidodendron laricinum* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 1, p. 23, pl. 11, figs. 2-4.
 1825. *Lepidofloyos laricinum* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 4, p. XIII.

¹ Schimper, 1874, p. 532.

- 1850. *Lepidophloyos laricinus* Sternberg. Unger, Genera and Species, p. 278.
- 1853. *Lepidophloios laricinus* Sternberg. Newberry, Annals of Science, Vol. I, p. 96.
- 1866. *Lepidophloyos obcordatum* Lesquereux (pars), Geol. Survey of Illinois, Vol. II, p. 457, pl. 41, figs. 2-2a (non fig. 1).
- 1870. *Lepidophloios lepidophyllifolius* Goldenberg. Schimper, Traité de Paléont. Végétale, Vol. II, p. 52, (syn. only).
- 1880. *Lepidophloios obcordatus* Lesquereux, Coal Flora of Penn., Vol. II, p. 423.
- 1886. *Lepidophloios laricinus* Sternberg. Kidston, Catalogue of Palaeozoic plants in the British Museum, pp. 169, 170.
- 1930. *Lepidophloios laricinus* Sternberg. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 423.
- 1930. *Lepidophloios lepidophyllifolius* Goldenberg. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 437 (syn. only).
- 1930. *Lepidophloios obcordatus* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 440.

Original Description of *Lepidophloyos obcordatum* Lesquereux:

Scales lanceolate, truncate, inflated in the middle; scars of the decorticated surface cordiform, obtuse, overtopped by buttonlike, round, small crowns, corresponding with the base of the scales. In figure 2 the scars have nearly the same general outline, dilated on both sides, obtuse below, showing above a vascular scar about of the same form, marked by three horizontal points. Du-Quoin, Illinois, and Coal No. 3, Colchester, Illinois.

Discussion:

The two specimens thus described by Lesquereux are probably of different species. Only the one designated as figure 2, plate 41, Vol. II of the report of the Geological Survey of Illinois was available for the present study, and it alone is being considered here. This specimen, as Lesquereux himself later suggested might be the case,¹ is undoubtedly an imperfectly preserved specimen of *Lepidophloios laricinus* Sternberg. As is true of some preservations of this species, and likewise of Lesquereux's specimen, the "scales," or leaf cushions, are closely overlapping, thus obscuring the corresponding leaf-scar traces on the cushions beneath.

Conclusion:

It is concluded that type specimen figure 2 of *Lepidophloyos obcordatum* Lesquereux should be referred to *Lepidophloios laricinus* Sternberg. Since specimen number 1 was not available for the present study, no conclusion is being made regarding that part of the species.

¹ Lesquereux, 1880, p. 424.

ASOLANUS Wood (1861)

(Proc. Academy of Natural Science of Philadelphia, Vol. XII, p. 237)

ASOLANUS CAMPTOTAENIA Wood

(SIGILLARIA MONOSTIGMA Lesquereux)

(SIGILLARIOIDES STELLARIS Lesquereux)

(LEPIDODENDRON CRUCIATUM Lesquereux)

Plates V, VI

- 1860-61. *Asolanus camptotaenia* Wood, Proc. Acad. Nat. Sci. Phila., Vol. XII, p. 238, pl. 4, fig. 1.
1866. *Asolanus camptotaenia* Wood, Trans. Amer. Phil. Society, Vol. XIII, p. 342, pl. 9, fig. 3.
1866. *Sigillaria monostigma* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 449, pl. 42, figs. 1-5.
1870. *Sigillaria (Knorria) monostigma* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 446, pl. 26, fig. 5.
1870. *Sigillarioides stellaris* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 450, pl. 29, fig. 3.
1870. *Lepidodendron cruciatum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 432, pl. 25, fig. 2.
- 1870-72. *Sigillaria monostigma* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. II, p. 101.
1874. *Lepidodendron cruciatum* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 535.
1877. *Pseudosigillaria monostigma* (Lesquereux) Grand'Eury, La Flore Carbonifère du Loire, p. 144.
- 1879-84. *Sigillaria monostigma* Lesquereux, Coal Flora of Penn., Vol. II, p. 468; Vol. III, p. 793, pl. 73, figs. 3-6.
- 1879-80. *Stigmara stellaris* Lesquereux, Coal Flora of Penn., Vol. II, p. 516, pl. 74, figs. 5, 7.
- 1883-84. *Stigmara ficoides* Brongniart var. *stellata* Goeppert. Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 96, pl. 19, fig. 4.
1888. *Sigillaria camptotaenia* Wood. Zeiller, Valenciennes, p. 588, pl. 88, figs. 4-6a.
1899. *Sigillaria (Asolanus) camptotaenia* Wood. White, U. S. G. S. Monograph 37, p. 230, pl. 69; pl. 70, figs. 1-4b.
1904. *Lepidodendron cruciatum* Lesquereux. Fischer, Abhandl. K. Preuss. Geol. Landes., N. F. 39, p. 40.
1906. *Sigillaria monostigma* Lesquereux. Zeiller, Blanzky & Creusot, p. 157.
- 1913-32. *Asolanus camptotaenia* Wood. Jongmans, Fossilium Catalogus, Vol. II, Part 1, p. 4; Part 18, p. 874.
1932. *Sigillarioides stellaris* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 18, p. 985.
1939. *Asolanus camptotaenia* Wood. Janssen, Leaves and Stems from Fossil Forests, p. 45, fig. 24.

Original Description of *Sigillaria monostigma* Lesquereux:

In its decorticated state, the scars are broadly rhomboidal, acute at the sides, marked near the obtuse upper angle by a small, round, vascular scar and

a central point, resembling by its general form, that of a *Stigmara*, but much smaller. The surface between the cicatrices is striated by straight, parallel, narrow lines, running in the direction of the four axes or perpendicular to the four sides of the rhomboidal scar. These scars bear on both sides, from the corners of their acute angles, inwardly curved appendages like those of some species of *Lepidodendron*. In the decorticated state, the striae of the surface are obliterated and the scars have various forms, changing from rhomboidal to oval, then to arched lines or to round points only, representing the vascular scars, which are generally preserved. Colchester, Illinois.

Original Description of *Sigillarioides stellaris* Lesquereux:

Stem cylindrical, half a foot in diameter, irregularly inflated and contracted, obliquely crossing the shale, marked on its surface by small, round, slightly angular, sometimes nearly square or triangular cicatrices, in exact quincunxial order. These are slightly upraised above the surface, truncate, without trace of vascular point. Surface obscurely wrinkled between the scars, with lines diverging starlike toward the nearest cicatrices. Morris, Illinois.

Original Description of *Lepidodendron cruciatum* Lesquereux:

Surface furrowed by deep, irregular grooves, diverging from the scars in quincunxial direction; cicatrices distant, deeply cut in the shale, but irregular and variable, generally oval and narrowed downwards. The supercortical layer of coaly matter is very thick, one line at least, deeply, narrowly and regularly striate, filling the depressions or hollow scars, and obliterating their forms. Morris, Illinois.

Discussion:

The three species thus described do not differ essentially in any pertinent detail from *Asolanus camptotaenia* Wood, and described by him as follows: "Stem striate; striae disposed in two series; in the one, contiguous, numerous, descending towards the right; in the other, few, and *ascending* towards the right; cicatrices sub-triangular, rounded at apex, acuminate at the base; vascular scars almost obsolete.¹ Since this description was published, the species has been found in numerous localities in North America and Europe, having become so well known as to require no further discussion here.

As indicated in the synonymy above, various authors have referred the three species under consideration to *A. camptotaenia*. In discussing *Lepidodendron cruciatum*, Lesquereux himself says: "The species is uncertain and not satisfactorily known."² An examination of the specimen shows that it is a decorticated example. The specimen designated as *Sigillarioides stellaris* bears a superficial resemblance to *Stigmara* because of its mode of preservation. Apparently the stem was buried while in a more or less vertical position, and

¹ Wood, 1860-61, p. 238.

² Lesquereux, 1870, p. 432.

the weight of overlying sediments compressed it obliquely, giving it a deformed shape differing somewhat from horizontally preserved stem impressions. The specimens which were named *Sigillaria monostigma* are indistinctly preserved, but normal, examples of the stem, and without doubt are identical with *A. camptotaenia*.

Conclusion:

It is concluded that the three types, *Sigillaria monostigma*, *Sigillarioides stellaris*, and *Lepidodendron cruciatum*, all of Lesquereux, represent various forms of preservation and decortication of *Asolanus camptotaenia* Wood. They should be discarded as valid types, and are referred to the latter species which has priority.

BOTHRODENDRON Lindley & Hutton (1833) (Fossil Flora of Great Britain, Vol. II, Pls. 80, 81)

BOTHRODENDRON sp. (SIGILLARIOIDES RADICANS Lesquereux) Plate VIII, fig. 1

- 1870. *Sigillarioides radicans* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 449, pl. 31, fig. 4.
- 1879-80. *Sigillarioides radicans* Lesquereux, Coal Flora of Penn., Vol. II, p. 517, pl. 75, fig. 6.
- 1883-84. *Sigillarioides* sp. Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 96, pl. 19, fig. 6.
- 1932. *Sigillarioides radicans* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 18, p. 984.

Original Description of *Sigillarioides radicans* Lesquereux:

Primary axis cylindrical, about one inch broad, irregularly inflated and strangulated towards the narrower base, bearing long tubular rootlets or leaves attached to rhomboidal cicatrices, which are narrowed on both acute sides, and marked in the middle by a broad vascular point; leaves or rootlets more than one line broad, marked in the middle by a vascular line or medial nerve. The scars are tolerably distant, and without any regularity of position relatively to each other. Though slightly variable in form, they are so remarkably similar to those of *Sigillaria monostigma*, that the intimate relation of these remains cannot well be doubted. This specimen is interesting, especially as seemingly indicating a similarity of scars between some species of trees of the Coal Measures and their roots. Mazon Creek, Illinois.

Discussion:

The rhomboidal character of the scars, and the presence of appendages similar to sterile lycopod leaves indicates that this speci-

men is a stem rather than a root. Furthermore, it appears that Lesquereux figured and described his specimen in an upside down position. When reversed, it presents a more normal aspect of a small foliar tree branch. The scars, as suggested, are similar in shape to Lesquereux's *Sigillaria monostigma* (= *Asolanus camptotaenia* Wood). They have been replaced by mineral matter, however, so that their exact nature is not recognizable. In addition, the radiating striations which characterize *A. camptotaenia* are not present.

The specimen bears a close similarity to *Bothrodendron minutifolium* Boulay as pictured by Zeiller in his Valenciennes, plate 74, figure 3 with the exception that the scars are not in such regular order. The specimen is quite fragmentary, and since it is also indistinctly preserved, specific determination seems inadvisable.

Conclusion:

It is concluded that *Sigillarioides radicans* Lesquereux does not represent a form of root, and should be discarded as a valid species. The specimen is referred to *Bothrodendron* sp. Since *S. radicans* was also the genotype, the genus *Sigillarioides* should also be discarded. Lycopod-like roots and rootlets which cannot be referred to *Stigmaria* Brongniart or *Stigmariopsis* Grand'Eury are referable to *Stigmarioides* Lesquereux.

BERGERIA Presl (1838)

(In Sternberg, Versuch der Flora der Vorwelt, Vol. II, fasc. 7-8, p. 138)

BERGERIA sp.

(LEPIDODENDRON FORULATUM Lesquereux)

(LEPIDODENDRON OBSCURUM Lesquereux)

(SIGILLARIA CORRUGATA Lesquereux)

Plate VII

- 1866. *Lepidodendron obscurum* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 453, pl. 44, figs. 1-3.
- 1870. *Lepidodendron forulatum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 431, pl. 23, figs. 5-8.
- 1870. *Sigillaria corrugata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 445, pl. 24, fig. 4; pl. 25, fig. 5.
- 1870-72. *Lepidodendron diplotegioides* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. II, p. 28 (syn. only).
- 1874. *Lepidodendron forulatum* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 534.
- 1879. *Lepidodendron obscurum* Lesquereux. Fairchild, Annals New York Academy of Science, Vol. I, pp. 86, 90.

- 1879-80. *Lepidodendron forulatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 390, pl. 63, figs. 9-10a.
1880. *Lepidodendron obscurum* Lesquereux, Coal Flora of Penn., Vol. II, p. 397.
1880. *Sigillaria corrugata* Lesquereux, Coal Flora of Penn., Vol. II, p. 475.
1904. *Bergeria* Presl. Fischer, Abhandl. K. Preuss. Geol. Landes., N. F. 39, pp. 45, 55.
1904. *Lepidodendraceae* (?). Koehne, Abhandl. K. Preuss. Geol. Landes., N. F. 43, p. 94.
1905. *Bergeria* Presl. Fischer in Potonié, Abbild. und Beschreib. foss. Pflanz., Part 3, No. 42, p. 4.
1929. *Lepidodendron forulatum* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 175.
1929. *Lepidodendron obscurum* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 244.
1932. *Sigillaria corrugata* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 18, p. 773.

Original Description of *Lepidodendron forulatum* Lesquereux:

Cicatrices distant, oval, narrower and pointed at both ends, wrinkled across; leaf scar large, central, marked with three distinct large vascular points, without medial line or appendages; corticated surface deeply undulate-wrinkled lengthwise, marked by deep, narrow, equally distant furrows, separating the cicatrices in vertical rows as in the genus *Sigillaria*. The decorticated surface is regularly striate lengthwise by narrow, nearly straight wrinkles, and has its cicatrices up-raised or convex-rhomboidal, split from the central point downwards, by a deep narrow line. St. Johns, Illinois.

Original Description of *Lepidodendron obscurum* Lesquereux:

Cicatrices flat, rhomboidal, obscurely marked, distant and separated by longitudinal, deep, slightly undulate striae, becoming more and more marked, and forming deep furrows in the old part of the trees. Vascular scars central, round or oval, irregular, without appendages and tubercles. Chester Group, Pope County, Illinois.

Original Description of *Sigillaria corrugata* Lesquereux:

Cortex very rugose or deeply wrinkled in the length, marked by linear-oval, elongated cicatrices, gibbous in the middle and cut by a round angular scar. Lower surface also wrinkled lengthwise with smooth, shallow striae, marked by cicatrices, oval in outline or somewhat pointed at the top, rounded in its lower part, marked in the middle by three irregular, vascular scars, placed in the shape of a horse-shoe, or by a semi-lunar scar which points downwards, and a mere vascular point. These cicatrices are one inch long, half an inch broad, distant, and placed in quaternate order. Marseilles, Illinois.

Discussion:

The validity of these three species has been questioned by several authors. Schimper considered *L. obscurum* to be a decorticated specimen of *L. diplotegioides* Lesquereux, and *L. forulatum* as possibly being a *Sigillaria*. Later, in the Coal Flora, Lesquereux him-

self admitted that *L. obscurum* might be referable to various decorticated forms of *Lepidodendron*, and that *S. corrugata* had a close resemblance to *Lepidodendron*. Fairchild united *L. obscurum* with *L. aculeatum* Sternberg. Fischer considered both *L. obscurum* and *L. forulatum* as examples of the decorticated, or *Bergeria*, stage of *Lepidodendron*. Koehne considered *S. corrugata* as being a decorticated *Lepidodendron*. Jongmans considers the illustrations, at least, as worthless.

An examination of the type specimens has confirmed the opinions of these authors that Lesquereux's specimens are all decorticated forms of *Lepidodendron*. The form called *L. forulatum* is impressed on opposite sides of a laminated shale fragment, on one side of which the imprint bears a superficial resemblance to *Sigillaria*. The longitudinal striae are not regular nor continuous, and probably represent wrinkles resulting from growth conditions or mode of preservation. All of the specimens resemble somewhat decorticated examples of *Lepidodendron rimosum* Sternberg as figured by David White in his Fossil Flora of the Lower Coal Measures of Missouri, U. S. G. S. Monograph 37, plate 54, figure 3. The specimens are all poorly preserved, and consequently have no specific value.

Conclusion:

It is concluded that *Lepidodendron forulatum*, *L. obscurum*, and *Sigillaria corrugata*, all of Lesquereux, should be discarded as valid types, and that the specimens be referred to *Bergeria* sp.

STIGMARIA Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 209)

STIGMARIA FICOIDES Sternberg

(STIGMARIA ELLIPTICA Lesquereux)

Plate VIII, fig. 3

- 1804. ——— Parkinson, Organic Remains, Vol. I, pl. 3, fig. 1.
- 1809. *Phytolithus verrucosus* Martin, Outlines, p. 203.
- 1809. *Phytolithus verrucosus* Martin, Petrificata Derbiensia, p. 23, pls. 11, 12, 12*.
- 1818. *Phytolithus verrucosus* Steinhauer, Trans. Amer. Philos. Soc., N. S. Vol. I, No. 18, p. 268, pl. 4.
- 1820. *Variolaria ficoides* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 1, pp. 22, 24, pl. 12, figs. 1-3.
- 1822. *Stigmaria* Brongniart, Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, pp. 209, 228, pl. 1, fig. 7.

- 1825. *Stigmara ficoides* Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 4, p. XXXVIII.
- 1825. *Ficoidites verrucosus* Artis, Antediluvian Phytology, pl. 10.
- 1828. *Stigmara ficoides* Sternberg. Brongniart, Prodrôme, p. 88.
- 1870. *Stigmara elliptica* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 451, pl. 29, fig. 2.
- 1884. *Stigmara elliptica* Lesquereux, Coal Flora of Penn., Vol. III, p. 843.
- 1886. *Stigmara ficoides* Sternberg. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 201.
- 1899. *Stigmara verrucosa* (Martin) S. A. Miller. D. White, U. S. G. S. Monograph 37, p. 244.
- 1910. *Stigmara ficoides* Sternberg. Seward, Fossil Plants, Vol. II, p. 227, figs. 204-205.
- 1936. *Stigmara elliptica* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 21, p. 1166.
- 1936. *Stigmara ficoides* Sternberg. Jongmans, Fossilium Catalogus, Vol. II, Part 21, p. 1167.

Original Description of *Stigmara elliptica* Lesquereux:

Stem thick, half a foot broad, flattened to one inch; cicatrices placed in regular spiral quaternate order, elliptical, more or less elongated and proportionately narrow, with a central, nearly round, small mammilla, marked in the middle by a vascular point. The species is perhaps referable to some of the numerous varieties ascribed by authors to *Stigmara ficoides*. Duquoin, Illinois.

Discussion:

An examination of the type specimen discloses that it is, as Lesquereux himself suggested, merely a form of *Stigmara ficoides* Sternberg. In addition to being flattened, the specimen shows evidence of lateral pressure, causing the scars to appear elliptical in outline rather than circular. No doubt, this feature suggested to Lesquereux the specific name, *elliptica*.

In 1822 Brongniart proposed the name *Stigmara* to replace Sternberg's genus *Variolaria* of 1820 because the latter was preoccupied by a fungus genus of Persoon, first used in 1794.

Conclusion:

It is concluded that *Stigmara elliptica* Lesquereux does not represent a distinct species, that the name should be discarded as a valid type, and that the specimen should be referred to *Stigmara ficoides* Sternberg.

STIGMARIOIDES Lesquereux (1880)

(Coal Flora of Pennsylvania, Vol. I, p. 333)

STIGMARIOIDES TRUNCATUS Lesquereux

Plate VIII, fig. 2

1870. *Stigmarioides truncatus* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 453, pl. 29, fig. 4.
- 1879-80. *Stigmarioides truncatus* Lesquereux, Coal Flora of Penn., Vol. I, p. 334, pl. 75, fig. 2.
1937. *Stigmarioides truncatus* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 22, p. 1201.

Original Description of *Stigmarioides truncatus* Lesquereux:

A cylindrical root, about one inch in diameter, with a smooth surface, marked with small round cicatrices, without order of position. These cicatrices vary much in size, and are evidently scars left at the base of short, horizontal, flat rootlets, scarcely one line broad, without mark of a vascular line. The vascular point is also absent in the middle of the scars, or marked by a mere cavity. This species resembles *Stigmaria Evenii*, which has the surface undulately ribbed and broader scars, and is also referable to this new genus. Mazon Creek, Illinois.

Discussion:

The genus *Stigmarioides* was established by Lesquereux for the inclusion of rootlets belonging to trees, or of uncertain affinity, which could not be definitely included in the genus *Stigmaria* Brongniart because of their irregularly arranged scars without vascular points. The genus should not be confused with *Stigmariopsis* Grand 'Eury, established for the inclusion of *Sigillaria* rootlets only.

Lesquereux mentioned the similarity of *Stigmarioides truncatus* to his *Stigmarioides (Stigmaria) eveni*. Unfortunately, the type specimen of the latter was not available for the present study. A comparison of the type specimen of *S. truncatus*, however, with Lesquereux's figured illustration and other specimens in the State Museum collection and identified as *S. eveni*, show a difference sufficient to warrant their retention as distinct forms, at least for the present. The scars of both forms are situated irregularly in relation to each other, but the distance between them varies considerably. Those of *S. eveni* are never more than two or three millimeters away from the next closest scar, and many are so close that they nearly touch each other. The scars of *S. truncatus* are more scattered, being at least four or five millimeters away from the next closest scar, with very few exceptions. The possible intergradation of this form with that of *S. eveni*, or other forms, has not yet been shown. Con-

sequently, there seems to be no justification for uniting them in the same species.

Conclusion:

It is concluded that *Stigmarioides truncatus* Lesquereux represents a distinct root form, and should be retained, at least for the present, as a distinct form species.

STIGMARIOIDES LINEARIS Lesquereux

Plate VIII, fig. 4

1870. *Stigmarioides linearis* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 455, pl. 31, fig. 2.
1879-80. *Stigmarioides linearis* Lesquereux, Coal Flora of Penn., Vol. I, p. 335, pl. 75, fig. 5.
1937. *Stigmarioides linearis* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 22, p. 1201.

Original Description of *Stigmarioides linearis* Lesquereux:

A long, linear, cylindrical root, half an inch thick, slightly tapering downwards, obtuse at the base or broken, bearing narrow linear leaves or radicles one line broad, without medial nerve, placed without order and without visible central point. The rootlets or the first divisions of the root are also marked with round scars, indicating a subdivision similar to that which is sometimes observable on leaves of *Stigmaria*. Mazon Creek, Illinois.

Discussion:

Lesquereux's illustration of the type specimen shows more scars upon the rootlet than actually exist, the reason being that impressions of the tiny shells of *Gyromices ammonis* Goeppert are scattered upon the surface and were mistaken for rootlet scars. Actual scars are quite distant, averaging from one-half to fully an inch apart. In this respect, the arrangement of the scars and lateral rootlets differs quite widely from *Stigmarioides truncatus* and *S. eveni*, both of Lesquereux. All specimens of these several forms are incomplete; hence, nothing is known as to their respective lengths. The genus *Stigmarioides* Lesquereux is a logical form-genus for the inclusion of such incompletely known rootlets.

Conclusion:

It is concluded that *Stigmarioides linearis* Lesquereux represents a distinct form of rootlet, and should be retained, at least for the present, as a distinct form species.

LEPIDOSTROBUS Brongniart (1828)
(Prodrome d'une Histoire des Végétaux Fossiles, p. 87)

LEPIDOSTROBUS VARIABILIS Lindley & Hutton

(LEPIDOSTROBUS TRUNCATUS Lesquereux)

(LEPIDOSTROBUS CONNIVENS Lesquereux)

Plate IX, figs. 3-4

- 1809. *Phytolithus plantites (imbricatus)* Martin (pars), *Petrificata Derbiensia*, pl. 14, fig. 5b.
- 1811. *Strobilus* Parkinson, *Organic Remains*, Vol. I, p. 428, pl. 9, fig. 1.
- 1828. *Lepidostrobis ornatus* Brongniart, *Prodrome*, p. 87.
- 1831. *Lepidostrobis variabilis* Lindley & Hutton, *Fossil Flora of Great Britain*, Vol. I, pls. 10, 11.
- 1831. *Lepidostrobis ornatus* Lindley & Hutton, *Fossil Flora of Great Britain*, Vol. I, pl. 26.
- 1870. *Lepidostrobis truncatus* Lesquereux, *Geol. Survey of Illinois*, Vol. IV, p. 442, pl. 31, fig. 5.
- 1870. *Lepidostrobis connivens* Lesquereux, *Geol. Survey of Illinois*, Vol. IV, p. 442, pl. 31, fig. 6.
- 1880. *Lepidostrobis connivens* Lesquereux, *Coal Flora of Penn.*, Vol. II, p. 441.
- 1886. *Lepidostrobis variabilis* Lindley & Hutton. Kidston, *Catalogue of Palaeozoic Plants in the British Museum*, p. 197.
- 1890. *Lepidostrobis ornatus* Brongniart. Zeiller, *Valenciennes*, p. 497, pl. 76, figs. 5-6.
- 1910. *Lepidostrobis variabilis* Lindley & Hutton. Seward, *Fossil Plants*, Vol. II, p. 187.
- 1930. *Lepidostrobis connivens* Lesquereux. Jongmans, *Fossilium Catalogus*, Vol. II, Part 16, p. 481.
- 1930. *Lepidostrobis variabilis* Lindley & Hutton, *Fossilium Catalogus*, Vol. II, Part 16, p. 515.

Original Description of *Lepidostrobis truncatus* Lesquereux:

Cone less than one inch long, round ovate, obtuse, truncate at base, with densely imbricated, short, lanceolate sporophyllae (blades). None of these can be distinctly seen, being compressed against the cone. Mazon Creek, Illinois.

Original Description of *Lepidostrobis connivens* Lesquereux:

Cone small, ovate obtuse, of the same size as the former, with long, narrow, linear lanceolate sporophyllae; blade as long as the cone, curved at its top and covering it. Mazon Creek, Illinois.

Discussion:

It should be noted that both of these species were later united by Lesquereux under *Lepidostrobis connivens* in his *Coal Flora of Pennsylvania*, Vol. II, p. 441. At this time he suggested that while they might represent distinct species, they might be also merely the broken tops of larger strobiles.

An examination of the type specimens shows no discernable specific characters, and it is evident that they are, as Lesquereux suggested, merely the tips of larger strobiles. In this respect, they agree very closely with specimens figured by Zeiller¹ under the name of *Lepidostrobus ornatus* Brongniart. According to Kidston,² *L. ornatus* is only a peculiar state of preservation of *L. variabilis* Lindley & Hutton. This opinion has been accepted by Seward,³ and will also be accepted here. Under *L. variabilis* are included various strobiles which may possibly belong to different species, but which lack definite characters upon which to separate them.

Conclusion:

It is concluded that *Lepidostrobus truncatus* and *L. connivens*, both of Lesquereux, do not represent distinct species, and should be discarded as such. They represent the tips of larger strobiles, and as such, are referred to *Lepidostrobus variabilis* Lindley & Hutton.

LEPIDOSTROBUS OBLONGIFOLIUS Lesquereux

Plate IX, fig. 1

- 1870. *Lepidostrobus oblongifolius* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 441, pl. 30, figs. 3-3b.
- 1874. *Lepidostrobus oblongifolius* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 544.
- 1879-80. *Lepidostrobus oblongifolius* Lesquereux, Coal Flora of Penn., Vol. II, p. 437, pl. 69, fig. 29.
- 1883-84. *Lepidostrobus oblongifolius* Lesquereux, Indiana Dept. of Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 83, pl. 16, fig. 8.
- 1886. *Lepidostrobus oblongifolius* Lesquereux. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 197.
- 1930. *Lepidostrobus oblongifolius* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 505.
- 1939. *Lepidostrobus*. Janssen, Leaves and Stems from Fossil Forests, fig. 51.

Original Description of *Lepidostrobus oblongifolius* Lesquereux:

A very fine specimen, representing an exact cross section of a cone. The central axis is one line broad, the blade one inch long, its breadth one-third of the length, oblong, obtusely pointed, squarely cut at the base, and without auricles; pedicel of the sporange narrow, lanceolate pointed, one-fourth of an inch long. In its length it corresponds exactly to the distance between the border of the axis and that of the line of circumference of the cone. The sporanges are obscurely marked on the stone, mixed with pyrites, but I could not detect any spores. Mazon Creek, Illinois.

¹ Zeiller, 1886, pl. 76, figs. 5-6.

² Kidston, 1886 (a), p. 199.

³ Seward, 1910, p. 187.

Discussion:

This species has leaf blades bearing a close relationship to that of *Lepidophyllum lanceolatum* Brongniart, as first pictured by Lindley & Hutton in their Fossil Flora of Great Britain, Volume I, plate 7. It differs, however, in the ratio between the relative lengths and widths of the leaf blades, or sporophylls. Those of *L. oblongifolius* are three times the length of their greatest width, whereas those of *L. lanceolatum* are from five to six times longer than their greatest width. The nature of the cone itself cannot be determined, since the specimen represents a single plane only in cross section. The nature of the leaf blades, however, establishes it as a form quite distinct from *L. lanceolatum*.

Conclusion:

It is concluded that *Lepidostrobus oblongifolius* Lesquereux represents a strobile bearing a distinct form of leaf, and should be retained as a valid species.

LEPIDOSTROBUS OVATIFOLIUS Lesquereux

Plate IX, fig. 5

- 1870. *Lepidostrobus ovatifolius* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 441, pl. 30, figs. 2-2b.
- 1874. *Lepidostrobus ovatifolius* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 544.
- 1879-80. *Lepidostrobus ovatifolius* Lesquereux, Coal Flora of Penn., Vol. II, p. 438, pl. 69, fig. 32.
- 1886. *Lepidostrobus ovatifolius* Lesquereux. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 197.
- 1925. *Lepidostrobus ovatifolius* Lesquereux. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 7, fig. 1.
- 1927. *Lepidostrobus ovatifolius* Lesquereux. Hirmer, Handbuch der Paläobotanik, Vol. I, p. 231.
- 1930. *Lepidostrobus ovatifolius* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, part 16, p. 505.
- 1939. *Lepidophyllum ovatifolium*, Lesquereux. Janssen, Leaves and Stems from Fossil Forests, p. 64, fig. 49.

Original Description of *Lepidostrobus ovatifolius* Lesquereux:

Cone about three inches long, one inch broad, with short, erect blades; blade obtuse at its base; lanceolate obtusely pointed, comparatively broad; pedicel of the sporanges short, lanceolate. The axis of the cone appears to be narrow, a peculiarity which does not agree with the shortness of the pedicel of the sporange. As the detached blade is copied from another specimen which is crushed, and whose form is unrecognizable, it may belong to a different species. Mazon Creek, Illinois.

Discussion:

The leaf blade of this species varies from those of *Lepidostrobus oblongifolius* Lesquereux and *L. lanceolatum* Brongniart by its more definitely ovate shape, more sharply tapering tip, and shorter length in proportion to its width. The blades are approximately two and one-half times as long as their greatest width, which is near the base.

Unfortunately, the type specimen itself is not preserved in such a way that these features are very readily distinguished. Most of the leaf blades are half buried in the matrix so that scarcely half, or less, of their surfaces can be seen. Their visible proportions, however, seem to agree closely with the single leaflet pictured by Lesquereux,¹ and which is apparently of the same species. This latter specimen was not available for the present study. Its definitely ovate form, with the widest portion near the base, is distinct from that of the foregoing species. It may possibly represent a terminal portion of the same type of strobile characterized by *L. oblongifolius* Lesquereux, but until intermediate forms are recognized there seems to be no justification for combining the two species.

Conclusion:

It is concluded that *Lepidostrobus ovatifolius* Lesquereux represents a strobile bearing a distinct form of leaf, and should be retained as a valid species.

LEPIDOSTROBUS LANCIFOLIUS Lesquereux

Plate IX, fig. 2

1870. *Lepidostrobus lancifolius* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 442, pl. 31, figs. 7-7b.
1874. *Lepidostrobus lancifolius* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 544.
1879-80. *Lepidostrobus lancifolius* Lesquereux, Coal Flora of Penn., Vol. II, p. 436, pl. 69, figs. 30-30a.
1930. *Lepidostrobus lancifolius* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 16, p. 493.

Original Description of *Lepidostrobus lancifolius* Lesquereux:

A small, apparently narrow cone. The pedicel of the sporanges is very short, broadly wedge-shaped, obtusely truncate at its base; blade one inch long, slightly enlarged in the middle, tapering into an acute point, with slightly diverging acute auricle at the base; medial nerve sharply marked. Mazon Creek, Illinois.

¹ Lesquereux, 1870, pl. 30, fig. 2b.

Discussion:

Except for the auriculate base, the leaf blade of this species is similar in form to that of *Lepidophyllum lanceolatum* Brongniart, as first pictured by Lindley & Hutton.¹ The blades of Lesquereux's specimen are slightly smaller than those of Lindley & Hutton; however, the proportions are the same, being in length approximately eight times that of the greatest width, which is near the middle. It is possible that the two forms are identical, but that the auriculate base was not preserved on the earlier described specimens. In the absence of definite proof in this respect, it seems inadvisable to unite the two forms.

Conclusion:

It is concluded that *Lepidostrobus lancifolius* Lesquereux represents a strobile bearing a distinct form of leaf, and should be retained as a valid species.

LEPIDOSTROBOPHYLLUM Hirmer (1927)

(Handbuch der Paläobotanik, Vol. I, p. 231)

LEPIDOSTROBOPHYLLUM MAJUS Brongniart

(LEPIDOPHYLLUM AURICULATUM Lesquereux)

(LEPIDOPHYLLUM ROSTELLATUM Lesquereux)

(LEPIDOPHYLLUM STRIATUM Lesquereux)

Plate X, figs. 1-3.

- 1822. *Filicites (Glossopteris) dubius* Brongniart, Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, pl. 2, fig. 4.
- 1828. *Lepidophyllum majus* Brongniart, Prodrôme, p. 87.
- 1855. *Lepidophyllum majus* Brongniart. Geinitz, Verstein. der Steink. in Sachsen, p. 37, pl. 2, fig. 5.
- 1866. *Lepidophyllum auriculatum* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 457, pl. 36, fig. 6.
- 1870. *Lepidophyllum rostellatum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 443, pl. 31, fig. 8.
- 1870. *Lepidophyllum striatum* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 443, pl. 31, fig. 9.
- 1870-72. *Lepidophyllum majus* Brongniart. Schimper, Traité de Paléont. Végétale, Vol. II, p. 72.
- 1880. *Lepidophyllum auriculatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 450.
- 1880. *Lepidophyllum rostellatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 451.

¹ Lindley & Hutton, 1831, pl. 7, fig. 4.

1880. *Lepidophyllum striatum* Lesquereux, Coal Flora of Penn., Vol. II, p. 452.

Original Description of *Lepidophyllum auriculatum* Lesquereux:

Blade long, lanceolate, pointed, a little enlarged in the middle, marked by a broad, medial nerve, bearing at the base two small, round auricles; pedicel of the sporanges thick, ovate, enlarged under the blade, a little obtuse at the base. Neelyville, Morgan County, Illinois.

Original Description of *Lepidophyllum rostellatum* Lesquereux:

A large blade, broken in the middle, four-fifths of an inch broad, with a triple medial nerve, round, attenuated at the base or strangled at its point of union to the pedicel; pedicel of the sporanges half an inch long, rounded at its enlarged sides, and narrowed to an acute, slightly curved point. The collum between the blade and the pedicel is long and narrow, giving the species a peculiar appearance. Mazon Creek, Illinois.

Original Description of *Lepidophyllum striatum* Lesquereux:

The specimen shows two blades and curved pedicels of sporanges. The blades, broken at the point and along the borders, are about half an inch broad, two inches and a half long, lanceolate, slightly enlarged above the middle, marked with one narrow medial nerve, and striated in the length with well marked parallel regular lines, nearly as strong as the medial nerve. The pedicels of the sporanges are still curved as in their normal position on the strobile, and appear linear. Mazon Creek, Illinois.

Discussion:

None of the three specimens under consideration is a complete individual, for all have the uppermost quarter to one-half of the blade missing. The proportions of all three are very nearly the same, and the actual differences in measurements are no greater than might be expected on different parts of a single strobile. The only essential difference in Lesquereux's descriptions of the specimens concerns the nervation. An examination of the specimens shows that each has a single medial vein bounded on each side by a lateral ridge such as is characterized by *Lepidostrobophylls* in general. This feature has been called a "triple medial nerve" by Lesquereux in his description of *L. rostellatum*, but has no specific meaning other than a way of describing this particular type of vein. The specimen described as *L. striatum* also has a single vein. What Lesquereux described as numerous lateral veins are merely longitudinal wrinkles, apparently caused by withering of the leaf prior to burial and fossilization. The small round auricles shown in Lesquereux's drawing of *L. auriculatum* are not a peculiarity of the specimen, but are an illusion caused by the manner in which the shale fractured at this point. It appears that all three specimens belong to the same species.

In this connection it should be noted that Jongmans¹ considers *L. rostellatum* to be a fragment of a large *Lepidophyllum*, and *L. striatum* as a broken fragment of a *L. majus* type. *Lepidophyllum auriculatum* is recognized as a distinct species by Jongmans, but this is due, no doubt, to the fact that he had not examined the type specimen, knowing it only as inaccurately illustrated by Lesquereux.

Conclusion:

It is concluded that the type specimens of *Lepidophyllum auriculatum*, *L. rostellatum*, and *L. striatum*, all of Lesquereux, should be discarded as valid types, and that the specimens should be referred to *Lepidostrobohyllum majus* Brongniart. The generic name is here adopted as suggested by Hirmer² for the inclusion of fertile leaves of *Lepidodendron*. The species was established by Brongniart³ with an illustration which he called *Glossopteris dubius* although no description was given at the time. He later changed the name to *Lepidophyllum majus* in his Prodrôme (p. 87), but again no description was given. The species was later described by Schimper⁴ under the latter name, a translation of which is as follows: "Bracts very large, at base an obovate-lanceolate sporangiophore to which is attached a short concave ligule; lanceolate-acuminate; costa thick, centrally located."

LEPIDOCYSTIS Lesquereux (1880)

(Coal Flora of Pennsylvania, Vol. II, p. 454)

LEPIDOCYSTIS VESICULARIS Lesquereux

(CARPOLITHES VESICULARIS Lesquereux)

Plate X, figs. 5, 7

1870. *Carpolithes vesicularis* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 462, pl. 31, figs. 19-21.
 1879-80. *Lepidocystis vesicularis* Lesquereux, Coal Flora of Penn., Vol. II, p. 457, pl. 69, figs. 18-20.
 1897-99. *Lepidocystis vesicularis* Lesquereux. D. White, U. S. G. S. 19th. Ann. Rept., Vol. III, p. 532.

Original Description of *Carpolithes vesicularis* Lesquereux:

This kind of fruit resembles a small bladder, which, by compression in various ways, has taken different forms. It is generally elongated, more inflated and obtuse on one side than on the other, cylindrical. Its surface is

¹ Jongmans, 1930, p. 468.

² Hirmer, 1927, p. 231.

³ Brongniart, 1822, pl. 2, fig. 4.

⁴ Schimper, 1870-72, p. 72.

smooth, generally covered with a thin coating of coaly matter, marked with broad wrinkles and undulations. Sometimes showing a kind of inflation or convexity, surrounded by a flattened border, resembling an endocarp and its exocarp. This form may be merely casual. Morris and Murphysboro, Illinois.

Discussion:

In his Coal Flora of Pennsylvania, Lesquereux referred this species to his new genus *Lepidocystis*, remarking that it might possibly represent the sporangium of *Lepidostrobus* (*Macrocystis*) *quadratus* Lesquereux. D. White¹ suggested its possible affinity to *Lepidophyllum mansfieldi* Lesquereux. It seems fruitless to attempt such speciation without definite evidence in the form of attached specimens. It is more consistent, therefore, to place detached specimens of spore cases in the form-genus *Lepidocystis*.

The type specimens figured by Lesquereux apparently represent three cotypes. Two of these appear to have been damaged so that their characteristics are no longer observable. The third, however, still exists in good condition. Several examples of this species have recently been observed in nodules from the Mazon Creek region. In a general way, they all resemble collapsed husks, pods, or seed cases of various modern fructifications. The manner of collapse determines more or less the shape of their impressions as fossils. Lesquereux has probably described them as accurately as is possible—a smooth surface texture, a somewhat rectangular shape, and relatively large size, together with a possible splitting, or dehiscence, in some individuals. Lesquereux's statement as to a possible differentiation into an endocarp and exocarp region is, as he himself suggested, merely incidental. This feature is the result of wrinkling, some specimens showing various undulations and wrinkles, and others being quite smooth.

Conclusion:

It is concluded that *Lepidocystis vesicularis* Lesquereux represents a form of what may be an actual sporangia. The species should be retained as a valid form-species for the inclusion of impressions having this same general size and proportions.

¹ D. White, 1897-99, Vol. III, p. 532.

LEPIDOCARPON Scott (1900)

(Proc. Royal Society, London, Vol. 67, p. 309)

LEPIDOCARPON CORTICOSUM (Lesquereux) Schopf*

(CARPOLITHES CORTICOSUS Lesquereux)

Plate X, fig. 6; Plate X bis; text fig. 1

1870. *Carpolithes corticosus* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 462, pl. 31, fig. 17.
1880. *Carpolithes corticosus* Lesquereux, Coal Flora of Penn., Vol. II, p. 595.
1938. *Lepidocarpum* sp. Schopf, Illinois State Geological Survey Report of Investigations No. 50, pl. 8, figs. 6-8.

Original Description of *Carpolithes corticosus* Lesquereux:

A small flattened nutlet, oval, short pointed at one end, (the point turned on one side) and covered with a thin yellowish membranaceous pellicle. It is surrounded by a proportionately thick pericarp, having the same form, and being a compound of crystallized iron. Mazon Creek, Illinois.

Reference to Original Description:

The description published by Lesquereux is of little value in characterizing this species. It refers to the specimen as a "nutlet" which indicates that the lamina (attached at right angles to the pedicel) and the attached splinter of cone axis which bore the sporophyll were unrecognized. Consequently the structure was presumed to be a gymnospermic fruit properly assignable to *Carpolithes*. The chief feature which suggested this affinity probably was the yellowish membrane of the seed megaspore, the "thin yellowish membranaceous pellicle," which resembles in color the megaspore membranes commonly visible in compression specimens of other types of Paleozoic seeds. The rest of his description, and particularly the single illustration which was published in 1870, is ambiguous and misleading.

The proof that this specimen is really authentic rests chiefly on the museum number "1661" inked on the nodule and on the revised identification recorded by David White in the Catalog of the Illinois State Museum. The entry in the Catalog originally given was "No. 1661, *Carpolithes corticosus*, Coal Measures, Mazon Creek, Illinois, collected by Geol. Survey Illinois." Mr. White studied this collection of plant fossils in 1892, revised some of the identifications,

* Because of his familiarity with the fossil lycopod fructifications of Illinois, the type specimen was turned over to Dr. J. M. Schopf of the Illinois State Geological Survey for study and redescription. Thus the treatment of *Lepidocarpum corticosum* is by Dr. Schopf, and is quoted here by permission of the Chief of the Illinois State Geological Survey.

and had printed labels prepared for many of the specimens. These then were used as part of the Illinois exhibit at the 1893 World's Fair in Chicago. Mr. White in this instance crossed out the original identification of *Carpolithes* in the Museum Catalog and wrote in *Lepidophyllum* above it. He added his initials in the Catalog indicating the authority for this change. The name according to White both in the Catalog and on the printed exhibition cards was *Lepidophyllum corticosum* (Lesq.). Neither this nor any other of White's revision of the Illinois Museum Collections seem to have been published although A. R. Crook published a Catalog of the State Museum Fossil Collections in 1912 and some of White's revised names appear there. Number 1661 is listed there as "*Lepidodendron corticosum* Lesquereux (type)," no doubt referring to the same specimen. The alteration here of *Lepidophyllum* to *Lepidodendron* was surely an error because Lesquereux never published a "*Lepidodendron corticosum*." There is no reason to doubt that the present specimen No. 1661 is actually the holotype.

David White's identification of the specimen as *Lepidophyllum* should not be continued now since this genus is at present used in a more restricted sense. In addition later studies have shown that certain specialized features as exhibited by this and other specimens necessitate their assignment to the genus *Lepidocarpon* Scott. To Mr. White must go the credit of making the first essentially correct attribution of this specimen whose true nature had previously been unrecognized.

Two specimens were used in providing the following description; No. SB9, Illinois State Geological Survey Catalog, a topotype, and No. 1661, of the Illinois State Museum Catalog, Lesquereux's original specimen, the holotype.

Revised Description of *Lepidocarpon corticosum* (Lesq.) Schopf:

Sporophyll of medium size, sporangial structures elaborated into a fructification approximating the seed habit. Integumentary structures of the seed attach along the ventral extent of the pedicel and enclose the sporangium. Lamina adjoined to the pedicel distally, aligned nearly at right angles to it and prolonged downward into a distinct dorsal heel. The proximal end of the pedicel merges with a splinter of the former cone axis.

The pedicel proper is ca 12 mm. long; in figure 4, Plate X *bis*, the main connective strand is shown as a rather deep sulcus, a mold of the former tissue, ca 1 mm. deep to indicate that it originally possessed considerable substance. There is slight indication of a narrow(?) membranous keel along the lower side (Plate X *bis*, figure 1).



FIG. 1

Tracing from photograph of holotype (Pl. X *bis.*, fig. 2; Illinois State Museum No. 1661. Note position of small abortive megaspore near anterior of seed

Seed structure ca 11 mm. long and $7\frac{1}{2}$ mm. tall (including thickness of pedicel). The micropylar crest extends from the upper proximal corner of the seed body around its top and anterior. Crest is $2 - 2\frac{1}{2}$ mm. tall at its maximum slightly forward from the middle of the seed (Text figure 1; Plate X *bis.*, figs. 1 and 4). The crest evidently consisted of two thin laminae closely juxtaposed. They show a characteristic rugose texture, the rugae trending in vertical alignment; the marginal line is irregular. Structural details of integument and sporangium are obscure. A single fertile seed megaspore is present. It is elongate, asymmetrically oval, ca 7 mm. long by $3\frac{3}{4}$ mm. broad; the broader end is toward the anterior of the seed (Plate X *bis.*, figs. 1, 3b and 4). One abortive megaspore (ca 400μ diam.) is seen in place forward from the broad apical end of the fertile megaspore of the holotype (Text figure 1; Plate X *bis.*, figs. 1 and 2). Fertile megaspore membrane shows the characteristic fibrous texture (Plate X *bis.*, fig. 4). This feature has also been illustrated at higher magnification by Schopf (1938b, Pl. 8, fig. 6).

Structure at the anterior sinus between seed and lamina where the ligule is presumed to have been situated is obscure.

Lamina nearly straight, upstanding, $2 - 2\frac{1}{2}$ cm. long. Figure 3, Plate X *bis.*, shows the lamina slightly twisted to the side, lanceolate in outline, ca 4 mm.

broad at the widest point somewhat above the middle. The midrib is ca 1 mm. broad and slightly upraised on the ventral surface.

The dorsal heel projects downward ca 5 mm. from the distal end of the pedicel. It apparently does not connect in exact alignment with the lamina since there is a distinct indentation at this juncture on both specimens. However, this may possibly be an internal rather than an external tissue outline. The heel seems to be acutely pointed.

Discussion:

Recognition of this fructification as a species of *Lepidocarpon* is a result of investigations which led to the description of *Lepidocarpon mazonense* Schopf (1938a). In that species the integumentary structures were apparently quite sclerotic, and held their shape well during burial and subsequent preservation in the Mazon Creek nodules. The double laminae of the micropylar crest is indisputably demonstrated. The presence of at least fragments of fibrous seed megaspores in practically all specimens served to clinch its identification as a *Lepidocarpon*. In *L. corticosum* the two micropylar laminae of the crest are not nearly so discrete, and the seed is considerably compressed. This may be taken as evidence that the integument was thinner, or at least much less resistant to pressure in burial, than it was in *L. mazonense*. The obvious lycopod character of the sporophyll and the presence of well preserved seed megaspores in both of the available specimens show that *L. corticosum* must be related to *L. mazonense* well within the range of variation permitted to a genus. At the same time differences in size, in the alignment of the lamina and heel, and differences in preservation attributable to original differences in structure, show clearly that both are distinct species. When specimen SB9 was first discovered, the author was inclined to regard it as an immature form of *L. mazonense*. The megaspore illustrated on Plate II, figure 6, Trans. Ill. Acad. Sci. 30 (2) 1938, is from that specimen, and was there erroneously assigned to *L. mazonense*. Later, the closer agreement of this specimen to the type of *L. corticosum* became apparent, and now there can be no further doubt that both are reasonably normal representations of a distinct species.

While *Lepidocarpon corticosum* can best be interpreted by comparison with *L. mazonense*, its closest relationship, apparently, is with certain of the species which Bassler (1919) assigned to *Cantheliophorus*. This latter group was described entirely on the basis of compression specimens in shale. They are supposed to possess two

sack-like sporangia borne on a narrow sporangiophore; they are also described as having a median plate of tissue between, and rising above, the level of the paired sporangia. It seems to the writer that there is little basis for postulating any such complex structure. Bassler has mistaken the enormous fertile seed megaspore of *Lepidocarpon* for a sporangium; there appears no real evidence for the presence of two fertile megaspores ("paired sporangia") in his paper although it might conceivably be possible for two megaspores of the original tetrad to be enlarged and fertile in a few instances. The median plate he speaks of probably did not exist; the apparent structure is that of the micropylar crests which are practically fused in his specimens by compression in burial. If this interpretation is correct, there is no basis for separating *Cantheliophorus* from *Lepidocarpon*. It is therefore proposed that the species he described be transferred to *Lepidocarpon* as follows:

Cantheliophorus novaculeatus Bassler, 1919, p. 99 and 102, figs. 29-31 = *Lepidocarpon novaculeatum* (Bassler) Schopf n. comb.

Cantheliophorus robustus Bassler, 1919, p. 100 and 102, figs. 25-26 = *Lepidocarpon robustum* (Bassler) Schopf n. comb.

Cantheliophorus grandis Bassler, 1919, p. 98 and 102, fig. 3 = *Lepidocarpon grande* (Bassler) Schopf n. comb.

Cantheliophorus subulatus Bassler, 1919, p. 98-9 and 102, figs. 11-12 = *Lepidocarpon subulatum* (Bassler) Schopf n. comb.

Cantheliophorus ensifer Bassler, 1919, p. 99 and 102, figs. 15-16 = *Lepidocarpon ensiferum* (Bassler) Schopf n. comb.

Cantheliophorus sicatus Bassler, 1919, p. 100 and 102, figs. 28 = *Lepidocarpon sicatum* (Bassler) Schopf n. comb.

Cantheliophorus pugiatus Bassler, 1919, p. 101 and 102, fig. 27 = *Lepidocarpon pugiatum* (Bassler) Schopf n. comb.

Bassler also refigures and assigns to *Cantheliophorus* two species which Lesquereux (Coal Flora 1880, 1884) assigned to *Lepidophyllum*. Their structure is now believed to be in agreement with *Lepidocarpon*, and so these species are assigned as follows:

Lepidophyllum cultriforme Lesq., Coal Flora, 1884, p. 785, Pl. 108, fig. 2; cf. also Bassler, 1919, figs. 5-7 = *Lepidocarpon cultriforme* (Lesq.) Schopf n. comb.

Lepidophyllum linearifolium Lesq., Coal Flora, 1880, p. 452-4, Pl. 69, fig. 39; cf. also Bassler, 1919, figs. 1, 2, 8-10 = *Lepidocarpon linearifolium* (Lesq.) Schopf n. comb.

A species of lycopod sporophyll from the Waldenburg beds of Lower Silesia was illustrated by Potonié (Lehrbuch der Pflanzenpaleontologie, Berlin, 1899, p. 372, fig. 350) and named *Lepidophyllum waldenburgense*, although he provided no description. In the

course of his studies later, Bassler (1919, p. 101 and 102, figs. 19-21) supplied this deficiency. The valid species became *Cantheliophorus waldenburgensis* Potonié ex Bassler. It is now assigned to *Lepidocarpon* as *L. waldenburgense* (Potonié ex Bassler) Schopf n. comb. A specimen related to *L. waldenburgense*, and possibly to *L. pugiatum*, has recently been figured by Renier and Stockmans (1938), and given a new generic designation. The name there used is accompanied by no description, and consequently is invalid. It also appears to be without any justification on other grounds. The Renier and Stockmans specimen is indicated as conspecific with cones usually identified as *Lepidostrobus geinitzii* Schimper, but the evidence for this also is, at best, inconclusive.

Nathorst (1914, pp. 62-65) described two species of *Lepidophyllum* from Spitzbergen which Bassler placed in *Cantheliophorus* (loc. cit. p. 100). Nathorst is the only author who has seriously entertained the idea that some of these compressions might be assigned to *Lepidocarpon*. The writer believes that this is by far the most probable relationship for Nathorst's species *Lepidophyllum riparium* and *L. mirabile*. Consequently, the names *Lepidocarpon riparium* (Nathorst) Schopf n. comb. and *Lepidocarpon mirabile* (Nathorst) Schopf n. comb. are proposed. The lack of an apparent imprint of the usual large seed megaspore is the only feature which might seem to make this identification questionable. There seems to be no doubt that generic agreement exists for all other characters.

Miss Benson's suggestion (Ann. Bot. 34: 135-137, 1920) that Bassler's and Nathorst's specimens are referrable to *Sigillariostrobus* does not seem to hold since the obvious micropylar crest is not found in that genus, nor is the occurrence of the large seed megaspore taken into account. While Nathorst's illustrations do not show the latter, it will be impossible to accept them as microsporangiate until the microspores are actually demonstrated. This, by itself, does not effect their assignment to *Lepidocarpon* in any event.

Of these species, *Lepidocarpon novaculatum* (Bassler) and *Lepidocarpon robustum* (Bassler) seem, by all means, most closely related to *L. corticosum* as described here. They seem to agree so well in size and general form that these may actually be conspecific. The main distinction now apparent relates to development of the dorsal keel of the pedicel, which is greatest in *L. robustum*, and somewhat less developed in *L. novaculeatum*. The dorsal keel is only

obscurely apparent in *L. corticosum*. From Bassler's description, it seems doubtful that *L. robustum* can be consistently distinguished from *L. novaculeatum*, but the names should be continued until a critical restudy can be made in which the modern transfer and maceration methods are utilized. *Lepidocarpon corticosum*, *L. robustum* and *L. novaculeatum* are all from beds of Allegheny age.

Conclusion:

The specimen originally named *Carpolithes corticosus* by Lesquereux, and assigned to *Lepidophyllum* in notes by David White, is actually a valid species of *Lepidocarpon*. Species of *Cantheliophorus* described by Bassler also are referable to *Lepidocarpon*. *Lepidocarpon novaculeatum* (Bassler) and *L. robustum* (Bassler) are the species previously described which are closely related to *L. corticosum*. A restudy of this material is needed in order to precisely define how close this relationship may be.

NEUROPTERIS Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 233)

NEUROPTERIS SCHEUCHZERI Hoffmann

(NEUROPTERIS FASCICULATA Lesquereux)

Plate XIII, figs. 2-3

- 1827. *Neuropteris scheuchzeri* Hoffmann, in Kieferstein, Teutschland, Vol. IV, p. 157, pl. 1b, figs. 1-4.
- 1870. *Neuropteris fasciculata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 381, pl. 5, figs. 1-4.
- 1874. *Neuropteris fasciculata* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 472.
- 1879-80. *Neuropteris fasciculata* Lesquereux. Coal Flora of Penn., Vol. I, p. 93, pl. 24, figs. 5-6.
- 1886. *Neuropteris scheuchzeri* Hoffmann. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 95.
- 1897-99. *Neuropteris fasciculata* Lesquereux. D. White, U. S. G. S. 19th. Ann. Rept., Part 3, p. 503.
- 1899. *Neuropteris fasciculata* Lesquereux. D. White, U. S. G. S. Monograph 37, p. 132.
- 1908. *Neuropteris scheuchzeri* Hoffmann. Sellards, University Geological Survey of Kansas, Vol. IX, p. 414.
- 1925. *Neuropteris decipiens* Lesquereux. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 24, fig. 4.

Original Description of *Neuropteris fasciculata* Lesquereux:

Frond pinnately divided, bearing alternate ovate lanceolate pointed leaflets, variable in size irregularly rounded or auriculate at the base, being more extended on one side than on the other, or truncate on one side, and rounded on the other. Medial nerve distinct, and comparatively broad, either descending to the point of the leaflets, or disappearing at or below the middle, sometimes absent; veinlets thin, close to each other, scarcely distinct, arched, forking in ascending. Mazon Creek and Neelyville, Illinois.

Discussion:

In considering the occurrence of *Neuropteris scheuchzeri* Hoffmann in Kansas, Sellards¹ has offered the opinion that *N. fasciculata* does not constitute a distinct species, and has referred Lesquereux's specimens to *N. scheuchzeri* Hoffmann and *N. decipiens* Lesquereux. The distinction between the two latter species is not clear-cut, and there is a tendency among some authors to unite them.

Of the four specimens figured by Lesquereux as *N. fasciculata*, only two were available for the present study. These were designated as figures 2 and 3 of plate 5 of the Illinois Survey Volume of 1870. They are terminal leaflets of rather aberrant shape, and similar to varieties commonly found at Mazon Creek and elsewhere. Such clusters of leaflets are usually found detached from the fronds on which they grew, and no two are exactly identical. Occasionally they are found attached to stems bearing more typical leaflets of the *N. scheuchzeri-decipiens* type, as pictured by Noé in Bulletin 52 of the Illinois Geological Survey. It is evident, therefore, that such terminal leaflets do not constitute a distinct species. The two specimens here under consideration are of the *N. scheuchzeri* type.

Conclusion:

It is concluded that the type *Neuropteris fasciculata* Lesquereux does not constitute a distinct species, and that the specimens of terminal leaflets so named be referred to *Neuropteris scheuchzeri* Hoffmann.

NEUROPTERIS HETEROPHYLLA Brongniart

(NEUROPTERIS CAPITATA Lesquereux)

Plate XI

1822. *Filicites (Neuropteris) heterophyllus* Brongniart, Mémoires du Muséum d'Hist. Nat., Vol. VIII, p. 233, pl. 2, figs. 6a-b.
1825-32. *Neuropteris heterophylla* Brongniart. Sternberg, Versuch der Flora der Vorwelt, Vol. I, fasc. 4, p. 17; Vol. II, fasc. 5-6, p. 72.

¹ Sellards, 1908, p. 414.

1828. *Nevropteris heterophylla* Brongniart, Prodrôme, p. 53.
1828. *Nevropteris heterophylla* Brongniart, Histoire des Végétaux Fossiles, p. 243, pl. 71; pl. 72, fig. 2.
1837. *Neuropteris heterophylla* Brongniart. Lindley & Hutton, Fossil Flora of Great Britain, Vol. III, pl. 183.
1870. *Neuropteris capitata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 383, pl. 7, fig. 1; pl. 8, fig. 9.
1874. *Neuropteris capitata* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 473.
- 1879-80. *Neuropteris capitata* Lesquereux, Coal Flora of Penn., Vol. I, p. 103, pl. 23, figs. 1-3.
- 1886-88. *Neuropteris heterophylla* Brongniart. Zeiller, Valenciennes, p. 261, pls. 43, 44.
1910. *Neuropteris heterophylla* Brongniart. Renier, Paléont. du Terrain Houiller, pl. 99.
1939. *Neuropteris heterophylla* Brongniart. Janssen, Leaves and Stems from Fossil Forests, p. 156, figs. 145-146.

Original Description of *Neuropteris capitata* Lesquereux:

Frond or part of frond bi-pinnately divided, triangular in outline or tapering upwards from an enlarged base; pinnae linear, with alternate, oblong, short, very obtuse, broad, contiguous pinnules, and a proportionately very large triangular obtusely pointed terminal leaflet, obtusely lobed on each side near its base. Medial nerve, none; veinlets scarcely visible to the naked eye, coming out from the narrowed base of the leaflets, strongly arched towards the borders, with numerous bifurcations. At the upper part, or near the point of the frond, the pinnae become shorter, less divided, and at last mere pinnules attached to the rachis by a broad pedicel. All leaflets are unsymmetrical at the base, being auricled or elongated downwards, or toward the main rachis, and merely rounded on the other side. Murphysboro and Mazon Creek, Illinois.

Discussion:

Of the two specimens figured by Lesquereux, only the one designated as figure 1, plate 7 of the 1870 report of the Illinois Geological Survey was available for the present study. The description of this species is accurate except as pertains to the venation. The veinlets cannot truly be said to be "scarcely visible to the naked eye," for actually they are readily discernable, and under a glass are quite distinct. On the better preserved pinnules a single vein can be seen to originate from the rachis. This immediately forks once or twice at the base of the pinnule, after which there may be from two to four additional bifurcations before the margin of the pinnule is reached. The specimen conforms in general to the character of *Neuropteris heterophylla* Brongniart, and appears to represent the terminal portion of a frond. The terminal pinnule of each pinna

is unusually large, and is relatively wider than some forms of this species in which this feature is quite variable.

Conclusion:

It is concluded that *Neuropteris capitata* Lesquereux should be discarded as a valid species, and that the specimen should be referred to *Neuropteris heterophylla* Brongniart.

LINOPTERIS Presl (1838)

(In Sternberg, Versuch der Flora der Vorwelt, Vol. II, fasc. 7-8, p. 167)

LINOPTERIS MÜNSTERI Eichwald

(DICTYOPTERIS RUBELLA Lesquereux)

Plate XIII, fig. 1

- 1840. *Odontopteris münsteri* Eichwald, Urwelt Russlands, p. 87, pl. 3, figs. 2a-b.
- 1849. *Dictyopteris münsteri* Eichwald. Brongniart, Dictionnaire Universal d'Histoire Naturelle, Vol. XIII, p. 19.
- 1870. *Dictyopteris rubella* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 388, pl. 7, figs. 2-6.
- 1874. *Dictyopteris rubella* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 514.
- 1879-80. *Dictyopteris rubella* Lesquereux, Coal Flora of Penn., Vol. I, p. 145, pl. 23, figs. 7-10.
- 1884. *Dictyopteris rubella* Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 55, pl. 11, fig. 4.
- 1886-88. *Dictyopteris münsteri* Eichwald. Zeiller, Valenciennes, p. 294, pl. 49, figs. 1-5.
- 1897. *Linopteris münsteri* (Eichwald) Potonié, Lehrbuch der Pflanzenpalaeontologie, p. 154.
- 1903. *Linopteris muensteri* (Eichwald) Potonié, Abbild. und Beschreib. foss. Pflanz., Part 1, No. 17.
- 1921. *Linopteris münsteri* Eichwald. Potonié, Lehrbuch der Paläobotanik, p. 101.

Original Description of *Dictyopteris rubella* Lesquereux:

Frond bi or tripinnate; pinnae linear-lanceolate, with alternate oblong or oval-lanceolate leaflets, attached to the rachis by a broad pedicel. The inferior basilar lobes, as is generally the case in the species of the genus *Neuropteris*, are slightly longer or protracted into a little obtuse auricle. The terminal leaflet, somewhat broader and longer, is oval in outline, obtuse, and cut on one side into a short obtuse lobe. The leaflets of the large inferior pinnae are more distant, larger, truncate at the base, slightly scythe-shaped outwards; and the axillar pinnules, still larger and cylopteroidal in form, are attached around the stem by a half circular notch, nearly surrounded by two broad auricles. The veins, anastomosing from the base without medial nerve and in their undulations forming oval-polygonal elongated meshes, curve towards the borders,

where the last divisions end in arched close lines. Low coal, Murphysboro, Illinois.

Discussion:

Of the several specimens figured by Lesquereux, only the cyclopteroid pinnule, designated as figure 4, plate 7, in the 1870 volume of the Geological Survey of Illinois, was available for the present study. The specimen has been correctly described and figured by Lesquereux, and is, no doubt, merely a cyclopteroid form of the same species as the remaining figures. It bears a very close resemblance to a cyclopteroid leaflet pictured by Zeiller in his Valenciennes, plate 49, figure 4, and identified as *Dictyopteris münsteri* Eichwald. The venation is less distinct, however, in Zeiller's specimen. According to Potonié,¹ the occurrence of cyclopteroid pinnules is common to this species. Potonié² has also pointed out that the genus *Dictyopteris* Gutbier (1835) was preoccupied in 1809 by Lamaroux for a genus of brown algae. The genus *Linopteris* Presl³ was established in 1838 for leaves of this type, and hence should properly be used.

Lesquereux's species, *Dictyopteris rubella*, agrees in form with Eichwald's species, originally classified under the name, *Odontopteris münsteri*, the original description of which is translated as follows: "The leaflets of the bipinnate fronds are ovate, almost alternate, and are perfoliate; they are attached without a petiole, are therefore sessile, and without a midrib; the lateral veins or veinlets are forked and anastomozed, forming a network, thus presenting the appearance of a very delicate, fine vascular reticulation."⁴

Conclusion:

It is concluded that *Dictyopteris rubella* Lesquereux does not represent a distinct species, and the name should be discarded as invalid. The specimens are referred to *Linopteris münsteri* Eichwald.

¹ Potonié, 1903, p. 2; 1921, p. 101.

² Potonié, 1897, p. 154.

³ Presl in Sternberg, 1838, p. 167.

⁴ Eichwald, 1840, p. 87.

ODONTOPTERIS Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 234)

ODONTOPTERIS SUBCUNEATA Bunbury

(ODONTOPTERIS HETEROPHYLLA Lesquereux)

Plate XII, figs. 1-2, 4-5

1847. *Odontopteris subcuneata* Bunbury, Quart. Jour. Geol. Soc. London, Vol. III, p. 427, pl. 23, figs. 1a-1b.
1866. *Odontopteris heterophylla* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 433, pl. 38, figs. 2-5.
1869. *Odontopteris heterophylla* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. I, p. 464.
- 1879-80. *Odontopteris heterophylla* Lesquereux, Coal Flora of Penn., Vol. I, p. 129, pl. 22, fig. 6.
1938. *Odontopteris subcuneata* Bunbury. Bell, Fossil Flora of Sydney Coal-field, Nova Scotia, p. 62, pl. 57, figs. 1-8; pl. 58, figs. 1-3.
1938. *Odontopteris cf. heterophylla* Lesquereux. MacKnight, Flora of Grape Creek Coal, Manuscript Ph. D. Thesis, Univ. of Chicago, p. 21, pl. 2, fig. a.

Original Description of *Odontopteris heterophylla* Lesquereux:

Frond bipinnately and tripinnately irregularly divided; pinnae lanceolate in outline or cordate ovate; pinnules either entire, oblong or obovate, obtuse, decurrent on the rachis, becoming broader, shorter, cuneiform, even, kidney-shaped at the base of the pinnae, or elongated, diversely lobed with unequal, long-linear or short, lanceolate, pointed divisions; terminal leaflet large, ovate-deltoid, obtuse, with an obtuse alternate short lobe on each side; veins sharply marked, inflated near the base, generally twice, rarely thrice forking. In the decurrent leaflets the veins are also somewhat decurrent on the rachis; in the oval, broad leaflets the veins are obliquely attached to it. This very variable species is known only from small specimens, found only at Murphysboro, Illinois.

Discussion:

All of the type specimens except one, designated as figure 5, plate 38, of the 1866 report of the Geological Survey of Illinois, were available for the present study. Each is fragmentary, and in no case is more than the uppermost portion of the pinnae preserved. Specimens of *Odontopteris subcuneata* Bunbury have recently been pictured by Bell¹ which more clearly show the nature of this odontopteroid form, and indicate that Lesquereux's specimens are undoubtedly the same. Bunbury's original description of *O. subcuneata* is translated from the Latin as follows: "Pinnules distant, subopposite, decurrent, oblique, obovate-cuneiform, slightly recurved, apex rounded; terminal leaf large, ovate; rachis with a broad margin; veins tenuous,

¹ Bell, 1938, p. 62, pls. 57 and 58.

arched, dichotomous."¹ This description agrees essentially with Lesquereux's description of *O. heterophylla*.

As shown by Bell,² the presence of basal auricles and arrangement of the pinnules relative to each other is of little specific importance. He figures specimens in which the pinnules are seen to be opposite, alternate, auriculate, and non-auriculate. Bunbury's type specimen has opposite, auriculate pinnules; while those of Lesquereux are sub-opposite and non-auriculate. One condition seems to grade into the other, and Bell shows further that in some cases the uppermost pinnules are non-auriculate, while those lower on the same pinna are auriculate. Bell suggests that the venation of Bunbury's specimen may have been inaccurately drawn in the illustration, since those in hand show a single vein entering the base, parallel to the rachis, and giving rise by numerous dichotomies to the smaller veinlets. The same is true of Lesquereux's specimens, although they are otherwise indicated in his drawings. This feature is very easily overlooked, since the downward course of the veins in the basal parts of the leaves adjacent to the rachis often obscures their true origin.

Conclusion:

It is concluded that *Odontopteris heterophylla* Lesquereux does not represent a distinct species, but is merely a variation of *O. subcuneata* Bunbury. Hence, the name should be discarded as invalid, and the specimens should be referred to *O. subcuneata* Bunbury.

CYCLOPTERIS Brongniart (1828)

(Prodrome d'une Histoire des Végétaux Fossiles, p. 51)

CYCLOPTERIS COLLINSII Lesquereux

(NEUROPTERIS COLLINSII Lesquereux)

Plate XII, fig. 3

- 1870. *Neuropteris collinsii* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 382, pl. 5, figs. 5-6.
- 1874. *Neuropteris collinsii* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 473.
- 1880. *Neuropteris collinsii* Lesquereux, Coal Flora of Penn., Vol. I, p. 87.

Original Description of *Neuropteris collinsii* Lesquereux:

The mode of division of this species is still unknown, as it has been found as yet only in separate leaflets. These leaflets are large, from two to three inches long, one and a half to two inches wide, either oval in outline or oblong

¹ Bunbury, 1847(b), p. 427.

² Bell, 1938, p. 62, pls. 57 and 58.

ovate, and smooth. The veins and veinlets are thin and distinct, inflated near the base, emerging from an oblique or horizontal truncate broad base, many times forking in ascending, and but slightly arched. The leaflets have no trace of a medial nerve, and could not, therefore, be referable to the genus *Nephopteris* Brongniart. Mazon Creek, Illinois.

Discussion:

Of the two type specimens figured by Lesquereux, only one was available for this study. It is designated as figure 5, plate 5, in the 1870 volume of the Geological Survey of Illinois, and has been correctly described by Lesquereux. The specimen is doubtless a form of basal leaf, of which there are many kinds. It is universally admitted that these various kinds of cyclopteroid leaflets do not represent a distinct genus, but were borne on the main rachises of *Neurop-teris* and *Odontopteris*. As suggested by Seward,¹ it is convenient, however, to retain the genus *Cyclopteris* Brongniart for the inclusion of detached specimens which cannot be assigned to the parent plant. Brongniart's description of the genus is translated as follows: "Leaf simple, entire, most frequently orbicular or reniform; veins numerous, all uniform, dichotomous, radiating from the base."²

Brongniart, together with several later writers, has established specific names for numerous isolated varieties of basal cyclopteroid leaflets. Nearly every leaflet is somewhat different from the next, and attempts to differentiate between them as a basis for classification is futile. Only when attached to the parent plant can they be satisfactorily identified. Several general shapes may be recognized, however, depending on whether the leaflet has an orbicular, reniform, oval, or oblong shape. Frequently the leaflets are preserved only in part, and the apparent margin is not the true one. Kidston³ has pointed out that this may be true of many preservations in concretions wherein the margin of the stone creates a false impression that it is also the margin of the leaflet. He adds that such is the case in respect to *Cyclopteris orbicularis* Brongniart, the specimen being merely an incomplete leaflet of *C. trichomanoides*. This seems to be true also for most of the other cyclopteroid leaflets pictured by Brongniart.

Cyclopteris trichomanoides Brongniart has priority over other names suggested for such leaflets. On the other hand, there is justification for retaining some of these specific names merely as form

¹ Seward, 1910, p. 571.

² Brongniart, 1828 (b), p. 215.

³ Kidston, 1886 (a), p. 90.

names for distinguishing among the several more or less commonly recognized varieties. Such a study is not within the scope of the present paper, but would be a suitable topic for future investigation.

Conclusion:

It is concluded that *Neuropteris collinsii* Lesquereux does not represent a distinct species, but is a form of basal cyclopteroid leaflet from an unknown member of the genus. Because of its elongate, rather than orbicular, shape it cannot be referred to *Cyclopteris trichomanoides* Brongniart unless it be deemed advisable to refer all basal cyclopteroid leaflets to this species. Until future work is done in regard to organizing the numerous cyclopteroid forms, it seems advisable to refer the specimen to the genus *Cyclopteris* without changing its specific status.

SPHENOPTERIS Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 233)

SPHENOPTERIS MIXTA Schimper

(SPHENOPTERIS RIGIDA Lesquereux [non Brongt.])

Plate XIII, fig. 4

- 1866. *Sphenopteris rigida* Brongniart. Lesquereux, Geol. Survey of Illinois, Vol. II, p. 435, pl. 39, figs. 5-6a (ex. syn.).
- 1869. *Sphenopteris (Cheil?) mixta* Schimper, Traité de Paléont. Végétale, Vol. I, p. 382.
- 1870. *Sphenopteris mixta* Schimper. Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 409, pl. 15, figs. 7-8.
- 1879-80. *Sphenopteris mixta* Schimper. Lesquereux, Coal Flora of Penn., Vol. I, p. 276, pl. 54, figs. 1-3a.
- 1883-84. *Sphenopteris mixta* Schimper. Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., p. 67, pl. 15, figs. 1-3.
- 1886-88. *Sphenopteris mixta* Schimper. Zeiller, Valenciennes, p. 95, pl. 12, fig. 3.
- 1889. *Sphenopteris mixta* Schimper. Kidston, Trans. Royal Soc. of Edinburgh, Vol. XXXV, No. 1, p. 405.
- 1899. *Sphenopteris mixta* Schimper. D. White, U. S. G. S. Monograph 37, p. 35, pl. 11, fig. 3; pl. 12, figs. 1-2; pl. 13, figs. 4-5.
- 1913. *Sphenopteris mixta* Schimper. D. White, West Virginia Geol. Survey, Vol. V (A), Part 2, p. 401.
- 1913. *Sphenopteris* cf. *mixta* Schimper. Gothan, Oberschlesische Steink., Vol. I, p. 35, pl. 8, figs. 4-4a.
- 1923. *Sphenopteris mixta* Schimper. Kidston, Carboniferous Rocks of Great Britain, Vol. II, Part 1, p. 75, pl. 11, figs. 6-6c.

Original Description of *Sphenopteris mixta* Schimper:

The form in question was originally referred to the species *Sphenopteris rigida* Brongniart by Lesquereux. Shortly afterward, Schimper recognized that such a reference was incorrect, whereupon he established a new species based on Lesquereux's specimen, naming it *Sphenopteris mixta*. His description, based on Lesquereux's drawn illustration, is translated as follows:

Frond bipinnate; pinna on a thread-like serpentine-flexuous rachis; pinnules closely spaced, hirsute; lower ones pinnatifid, lobes minute, precisely trilobate, entirely free; upper pinnules obovate, margin obtuse, crenulated; medial nerve pinnulate-ramose, ramification indistinct.¹

The establishment of this species was accepted by Lesquereux in Volume IV of the Geological Survey of Illinois issued the following year, and later in his Coal Flora of Pennsylvania. In the latter, Lesquereux² himself gives a more complete description of the species as follows:

Frond large, tripinnate; primary and secondary rachis thick, rough; divisions linear-lanceolate and in right angle; secondary pinnae with a very narrow flexuous rachis, pinnately divided; pinnules sublinear, obtuse, regularly undulately pinnately lobed; primary veins inclined to the rachis, not decurring, branching into each lobe; veinlets forking near the borders, the upper ones simple; texture rather membranaceous, surface smooth or polished. Colchester, Illinois.

Discussion:

The type specimen, unfortunately, is in a very poor state of preservation. The form of the pinnules and rachis are imperfectly impressed in the matrix, and the carbonaceous surface of the pinnules is almost entirely lost. There is little doubt, however, that the specimen is distinct from Brongniart's *Sphenopteris rigida*, and should not have been referred to it. Schimper was justified, therefore, in establishing a new species even though it was based on so poor a specimen. Better specimens, referred to this species and pictured by later authors, present a clearer aspect of its characteristics, and strengthen its position as a distinct species. The specimen figured by Kidston in his Carboniferous Rocks of Great Britain³ is probably the best illustration of this species.

¹ Schimper, 1869, p. 382.

² Lesquereux, 1880, p. 276.

³ Kidston, 1923, pl. 11, fig. 6.

Conclusion:

It is concluded that *Sphenopteris mixta* Schimper, when considered in the light of better preserved specimens, should be permitted to stand as a valid species.

SPHENOPTERIS ILLINOISENSIS D. White (*ALETHOPTERIS HYMENOPHYLLOIDES* Lesquereux [pars]) Plate XIII, fig. 5

- 1870. *Alethopteris hymenophylloides* Lesquereux (pars), Geol. Survey of Illinois, Vol. IV, p. 393, pl. 10, figs. 2-4 (non fig. 1).
- 1874. *Alethopteris hymenophylloides* Lesquereux (pars). Schimper, *Traité de Paléont. Végétale*, Vol. III, p. 500.
- 1879-80. *Pseudopecopteris hymenophylloides* Lesquereux (pars), Coal Flora of Penn., Vol. I, p. 196, pl. 56, figs. 3-3b (non fig. 2).
- 1899. *Sphenopteris illinoisensis* D. White, U. S. G. S. Monograph 37, p. 58, pl. 19, fig. 4; pl. 44, fig. 1.
- 1913. *Alethopteris hymenophylloides* Lesquereux (pars). Franke in Potonié, *Abbild. und Beschreib. foss. Pflanz.*, Vol. IX, No. 177, p. 3.

Original Description of *Alethopteris hymenophylloides* Lesquereux:

Frond large, tripinnately divided, with primary and secondary pinnae alternate, turned upwards, ovate-lanceolate in outline, decurrent in a narrow-winged rachis; secondary pinnae or pinnules either entire, short oblong, obtusely pointed, joined at the middle in acute sinuses; or longer, divided nearly to the base, ovate-lanceolate and pinnately cut into regular obtuse lobes with obtuse sinuses. In the short divisions, the medial nerve only is distinguishable; in the larger ones, the veins, though obscure, appear pinnately branching from the medial nerve in an acute angle and forking at the middle. But for this kind of nervation, this species should be considered as a *Hymenophyllites*. Mazon Creek, Illinois.

Discussion:

In establishing this species Lesquereux used two cotypes which, as David White¹ has already pointed out, are distinctly unlike. One has relatively small pinnae which are composed of dissected, obtusely toothed pinnules; the other has much larger pinnae possessing very large pinnules which are undissected. The two forms were separated by White, the former being instituted as a new species under the name *Sphenopteris illinoisensis*.¹ In establishing this name, White pointed out that such action was necessary inasmuch as a *Sphenopteris hymenophylloides* had already been established by Brongniart. The large form, comprising the other cotype, was not made the subject of further investigation, and has remained under the original

¹ White, 1899, p. 58.

classification as *Alethopteris hymenophylloides* Lesquereux. It is being considered elsewhere in the present work (see p. 63).

White's description of *Sphenopteris illinoisensis* is as follows:

Fronds tri- or poly(?) pinnate, lax, rather delicate; form of primary pinnae not sufficiently known for description; secondary (?) pinnae oblong-lanceolate, or lanceolate, acute, rather dense though delicate, the rachis being rather slender, finely lineate, rounded beneath, shallowly canaliculate on the upper side, with narrow thread-like central strand in relief on the back, giving off thread-like branches for the pinnae of the next order, and bordered by a wide lamina; ultimate pinnae alternate, oblong-lanceolate or oblong-triangular, broadest at base, rather blunt pointed, open or somewhat oblique, close, usually slightly overlapping, provided with simple or pinnatifid pinnules in the lower portion, becoming pinnatifid, and crenulate-lobate by the confluence of the pinnules near the top, and joined at the base of the decurrent lamina; rachis of the ultimate pinnae thread-like, terete on the back, nearly straight and often decurrent at the base to meet the superior rachis at a very narrow angle; pinnules alternate, oblique, usually at an angle of nearly 45 degrees of divergence from the rachis, close, usually touching or slightly overlapping, generally curving slightly upward, either when small, short, oblong, 2-2.5 mm. long; .75-1.5 mm. wide, obtuse or obtusely pointed at the top, connate up to near the middle, or, when larger, becoming ovate and oblong-ovate, obtuse, and developing at first 1 to 3 very erect, narrow, obtuse teeth above the middle, later bearing 4 to 6 short broad teeth, and, becoming cut into 6 to 9 longer obtuse teeth, soon passing the lobate stage into pinnules, the lower pair of which are usually quite oblique, although the lowest inferior pinnule is sometimes heteromorphous; lamina thin, smooth, slightly arched; nervation moderately clear; nerves narrow, straight or nearly straight, somewhat rigid, slightly depressed or obscure on the upper surface, distinct and somewhat in relief on the back; primary nerve emitted at an angle of about 45 degrees, very rarely decurrent at the base, and giving off simple branches at an angle of nearly 40 degrees; one nervil to pass into each lobe or crenulation, the dentate pinnules having but one simple, slightly upward turning, rigid nerve to enter each of the few teeth, the younger pinnules having a single nervil, which gives off a branch for each incipient crenulation or developing lobe; fructification unknown.¹

Conclusion:

It is concluded that the establishment of *Sphenopteris illinoisensis* D. White upon the basis of one cotype of *Alethopteris hymenophylloides* Lesquereux is well founded, and that the species, as redefined by White, should stand as valid.

DIPLOTHMEMA Stur (1877)

(Die Culm-Flora, Vol. II, p. 120 [226])

DIPLOTHMEMA ZOBELI Goeppert

(HYMENOPHYLLITES SPLENDENS Lesquereux)

Plate I, fig. 2a

1836. *Hymenophyllites zobelii* Goeppert, Der Fossilen Farrnkräuter, p. 260, pl. 36, figs. 3-4.

¹ White, 1899, p. 58.

1838. *Rhodea zobellii* Goeppert. Sternberg, Versuch der Flora der Vorwelt, Vol. II, fasc. 7, p. 110.
1869. *Sphenopteris* (*Hymen.*) *zobellii* Goeppert. Schimper, Traité de Paléont. Végétale, Vol. I, p. 404.
1870. *Hymenophyllites splendens* Lesquereux, Geol. Survey of Illinois, Vol. IV, pp. 411, 413, pl. 19, figs. 2a-b.
1874. *Sphenopteris* (*Davall.*) *polita* Schimper, Traité de Paléont. Végétale, Vol. III, p. 466.
1877. *Diplothmema zobellii* Goeppert. Stur, Die Culm-Flora, Vol. II, p. 229.
- 1879-80. *Sphenopteris* (*Hymen.*) *splendens* Lesquereux, Coal Flora of Penn., Vol. I, p. 283, pl. 56, figs. 4-4a.
- 1879-80. *Eremopteris missouriensis* Lesquereux, Coal Flora of Penn., Vol. I, p. 295, pl. 53, figs. 8-8a.
1885. *Diplothmema zobellii* Goeppert. Stur, Die Carbon-Flora, p. 332, pl. 29, figs. 13-14.
1886. *Sphenopteris zobellii* Goeppert. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 73.
1899. *Eremopteris missouriensis* Lesquereux. D. White, U. S. G. S. Monograph 37, p. 16, pl. 5, figs. 1-3; pl. 6.
1939. *Eremopteris missouriensis* Lesquereux. Janssen, Leaves and Stems from Fossil Forests, p. 114, figs. 93, 99k.

Original Description of *Hymenophyllites splendens* Lesquereux:

Frond tripinnate; primary pinnae at a right angle to the flattened main rachis, broadly lanceolate in outline; secondary pinnae alternate, narrowly ovate-lanceolate, oblique decurrent on the flexuous alate rachis, alternately two or three lobed on each side, the lobes divided in two or three lancolate, somewhat obtuse teeth. Veins in fascicles from the base of the secondary pinnae, separating in each lobe, one of the divisions ascending to the point.

This species resembles the variety of *H. furcatus* Brongniart, called *H. membranaceus* by Gutbier, which is common enough in Pennsylvania, especially in the upper part of the sandstone at Pottsville and Mauch Chunk. It differs, however, essentially, by the thick substance of the leaves which easily separates from the stone, by much thicker veins, merely approached in fascicles but not united at the base of the secondary pinnae, which are longer, narrower, more equally and pinnately divided in lanceolate pointed teeth.

This species appears intermediate between *H. furcatus* Brongniart, and *H. stipulatus* Gutbier. Colchester and Morris, Illinois.

Discussion:

The type specimen, which is preserved in a more or less macerated condition, is identical in all essential characteristics with *Hymenophyllites zobeli* Goeppert, originally described by him as follows: "Frond bipinnate or tripinnate; pinnae alternate, sessile, nearly horizontally extended; pinnules approximately flabelliform, obcordate, apex pointed, dentately cleft; divisions acute, unequal, single-nerved, rachis winged, furrowed, primary rachis jointed."¹

¹ Goeppert, 1836, p. 260.

The species was later referred by Stur to the genus *Diplothmema*, and is well illustrated by him in his Carbon-Flora, plate 29, figures 13-14. Comparison of his figures with Lesquereux's specimen indicates that they are the same.

The specimen also bears a marked similarity to *Eremopteris missouriensis* Lesquereux which was founded on a small fragment,¹ and in all probability belongs to the same species. Specimens figured by David White² under the name *E. missouriensis* are also referable to *Diplothmema zobeli*, there being no character whereby the two can be differentiated. It is of interest to note, also, that White suggests that the genus *Eremopteris* may be referable to *Diplothmema*.³

Conclusion:

It is concluded that *Hymenophyllites splendens* Lesquereux does not represent a distinct form and should be discarded as a valid species. The specimen is referred to *Diplothmema zobeli* Goeppert.

MARIOPTERIS Zeiller (1879)

(Bulletin de la Société Géologique de France,
Série 3, Vol. VII, p. 92)

MARIOPTERIS MAZONIANA Lesquereux

(ALETHOPTERIS MAZONIANA Lesquereux)

Plate XIV

- 1870. *Alethopteris mazoniana* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 391, pl. 9, figs. 1-8; pl. 13, figs. 5-6.
- 1874. *Alethopteris mazoniana* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 499.
- 1879-80. *Pseudopecopteris mazoniana* Lesquereux, Coal Flora of Penn., Vol. I, p. 190, pl. 32, figs. 1-7a.
- 1893. *Mariopteris (Pseudopecopteris) mazoniana* Lesquereux. D. White, U. S. G. S. Bulletin 98, p. 46.
- 1899. *Pseudopecopteris mazoniana* Lesquereux. D. White, U. S. G. S. Monograph 37, p. 22.
- 1912. *Mariopteris (Pseudopecopteris) mazoniana* Lesquereux. Huth in Potonié, Abbild. und Beschreib. foss. Pflanz., Vol. VIII, No. 142, p. 3.
- 1913. *Alethopteris mazoniana* Lesquereux. Franke in Potonié, Abbild. und Beschreib. foss. Pflanz., Vol. IX, No. 177, p. 4.
- 1925. *Mariopteris mazoniana* (Lesquereux) D. White. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 16.

¹ Lesquereux, 1880, p. 295.

² D. White, 1899, p. 16.

³ D. White, 1899, p. 18.

Original Description of *Alethopteris mazoniana* Lesquereux:

Frond evidently large, many times pinnately? divided, dichotomous at the end of the divisions; pinnae long linear, tapering slightly toward the points, either pinnately or bipinnately lobed; lobes oblong entire obtuse, joined near the base and perpendicular to the rachis, or longer broader linear obtuse regularly undulate, lobed on the borders, and more or less distinct and distant to the base. Medial nerve thin, but deeply marked; veins of the simple pinnules rather curved upwards, forking once only at the middle; in the undulated lobed leaflets, one of the veins ascends to the sinus, and is twice forked upwards. Mazon Creek, Illinois.

Discussion:

Of the several cotypes upon which this species was founded, four specimens were available for the present study. These are the ones designated as figures 1, 2, 3, and 7 of plate 9 in Volume IV of the Geological Survey of Illinois.

This species, originally referred to the genus *Alethopteris*, was removed by Lesquereux in 1880 to his new genus *Pseudopecopteris*.¹ David White has called attention to the fact that the genus *Mariopteris*, which had been proposed by Zeiller in 1879 for inclusion of essentially the same group of species, consequently has priority.²

Mariopteris mazoniana Lesquereux is distinct from other members of the genus by the polymorphous character of its pinnules, some possessing alethopteroid, and others pecopteroid, characteristics. Some pinnae apparently consist of one or the other type of pinnules throughout, while others have the alethopteroid character expressed near the tips, and becoming pecopteroid lower on the same pinna. Still others seem to be distinctly mariopteroid in that they are somewhat triangular in outline such as those of *Mariopteris nervosa* Brongniart.

Conclusion:

It is concluded that *Mariopteris mazoniana* Lesquereux represents a distinct species, and should be retained as valid.

ALETHOPTERIS Sternberg (1825)

(Versuch der Flora der Vorwelt, Vol. I, tentamen, p. XXI)

ALETHOPTERIS sp.

(ALETHOPTERIS INFLATA Lesquereux)

Plate XV, fig. 1

1870. *Alethopteris inflata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 393, pl. 10, figs. 5-6.

¹ Lesquereux, 1880, p. 190.

² D. White, 1893, p. 46, footnote; 1899, p. 22.

1874. *Alethopteris inflata* Lesquereux. Schimper, *Traité de Paléont. Végétale*, Vol. III, p. 500.
- 1879-80. *Callipteridium inflatum* Lesquereux, *Coal Flora of Penn.*, Vol. I, p. 174, pl. 33, figs. 9-9a.
1913. *Alethopteris inflata* Lesquereux. Franke in Potonié, *Abbild. und Beschreib. foss. Pflanz.*, Vol. IX, No. 177, p. 3.

Original Description of *Alethopteris inflata* Lesquereux:

Nothing has been found of this species but the fragment figured here. It shows part of a linear pinna, gradually tapering to the point, divided into broadly ovate, or ovate obtusely pointed lobes, enlarged and united near the base, marked in the middle by a short thick nerve pinnately divided by five or six pairs of arched veins forking once. The fructifications are marked by oval inflated large fruit-dots, placed at the base of the leaflets, one only on each side of the enlarged medial nerve. The surface covering these inflated fruit-dots is wrinkled above, and around them. In considering the form of its fructification, this species should be separated as the type of a peculiar genus. Mazon Creek, Illinois.

Discussion:

This species is based on a single, poorly preserved, fragment of a pinna. There seems to be very little justification for the contention that fructifications exist as described and pictured by Lesquereux. Large inflated spots occur at the bases of some of the pinnules, but these appear to be due to some peculiarity of preservation. They cannot be considered definitely as fructifications. The venation is indistinct. Each pinnule has a definite midvein from which lateral veinlets arch towards the margins. The lateral veinlets appear to fork once, but are too indistinct for certain description. In some places the veinlets are seen to extend across the inflations which were thought by Lesquereux to represent fructifications. Nearly three-quarters of a century has elapsed since this unusual form of so-called fruit was described by Lesquereux. It would seem that if it were a true fruiting character additional specimens would have been found somewhere during the intervening years. The shape of the pinnules is alethopteroid in character. It is reasonable to assume, therefore, that this specimen represents merely a peculiarly preserved fragment of an *Alethopteris*.

Conclusion:

It is concluded that *Alethopteris inflata* Lesquereux does not represent a distinct species. The name should be discarded as invalid, and the specimen be referred to *Alethopteris* sp. without attempt at specific identification.

DESMOPTERIS Stur (1883)

(Zur Morphologie und Systematik der Culm und Carbon-Farne, p. 68)

DESMOPTERIS sp.

(ALETHOPTERIS FALCATA Lesquereux)

(ALETHOPTERIS SOLIDA Lesquereux)

Plate XV, figs. 3-4

1870. *Alethopteris falcata* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 396, pl. 11, figs. 3-4.
1870. *Alethopteris solida* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 397, pl. 11, figs. 5-7.
1874. *Alethopteris solida* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 501.
- 1879-80. *Alethopteris solida* Lesquereux, Coal Flora of Penn., Vol. I, p. 261, pl. 48, figs. 6-6b.
1880. *Alethopteris falcata* Lesquereux, Coal Flora of Penn., Vol. I, p. 186.
- 1883-84. *Pecopteris solida* Lesquereux, Indiana Dept. Geol. and Nat. Hist., 13th. Ann. Rept., Part 2, p. 65, pl. 14, figs. 3-3b.
1913. *Alethopteris solida* Lesquereux. Franke in Potonié, Abbild. und Beschreib. foss. Pflanz., Vol. IX, No. 177, p. 6.

Original Description of *Alethopteris falcata* Lesquereux:

The specimen represents a part of a simply pinnate frond, or of a pinna with simple leaflets attached to a main broad smooth rachis, by their whole unconnected base. These pinnules, about two-inches long, are linear-lanceolate obtusely pointed, scythe-shaped and entire. The veinlets perpendicular to the half-round medial nerve, are very close to each other, very thin, either simple or forked from the base. Mazon Creek, Illinois.

Original Description of *Alethopteris solida* Lesquereux:

This species is known only by a fragment of a frond or pinna. It is pinnately divided into narrow leaflets, attached to a proportionately very broad flat rachis, by the enlarged base of a thick medial nerve. These pinnules, a little longer than one inch, perpendicular to the main rachis or slightly turned upwards, are linear obtusely pointed, disconnected at the enlarged rounded base, and entire. They bear along the borders, at equal distances from each other, round groups of sporanges, apparently divided star-like into five round dots. Mazon Creek, Illinois.

Discussion:

The specimen described as *Alethopteris falcata* is indistinctly preserved, and in all probability represents a member of the genus *Desmopteris* Stur. Only one-half of a pinna is preserved, and on this the pinnules are flexed in such a way as to give a plume-like aspect to the pinna. Such flexing may represent merely a condition of preservation. The pinnules are attached to the rachis by their whole base, are not confluent, and have a distinct midvein. Very

closely spaced, lateral veinlets can be recognized with difficulty. Lesquereux has described them as being simple or forked once. In this he is probably correct, but absolute confirmation is not possible. Except for its very fine venation, the general aspects of the type specimen suggest a close relationship to *Desmopteris belgica* Stur, as pictured in his Carbon-Flora, Part 1, plate 52, figures 7-9. It does not seem logical to attempt a specific determination on such a poorly preserved specimen having the details of venation so obscure.

The specimen described as *Alethopteris solida* represents an indistinct portion of a pinna preserved in a fragment of a concretion. The full length of the pinnules cannot be established, as they all appear to be broken off below the apexes. Lesquereux's description of the synangia and arrangement of the sporangia is largely inferred. Actually, only very faint indications of sporangia are discernable on the specimen, and these are too indistinct for identification. No trace of venation whatever can be seen. The specimen bears a rather close resemblance to forms figured by Brongniart¹ under the names *Phlebopteris polypodioides*, and *P. propinqua*, and by Lindley & Hutton² under the name *Pecopteris polypodioides* Brongniart. All of these illustrations show indistinct sporangia arranged upon the pinnules in the same manner as Lesquereux's specimen. They also show a venation which is desmopteroid in character. Lesquereux's specimen is undoubtedly a desmopterid of the same general type, but is too indistinctly preserved for specific determination.

Conclusion:

Because of the fragmentary nature and indistinct preservation of the two forms here under consideration, they have no value as distinct species. For the same reason, they cannot be assigned definitely to any other clearly defined species, since criteria which would identify them is not discernable. It is concluded, therefore, that *Alethopteris falcata* and *A. solida*, both of Lesquereux, should be discarded as valid species, and that the specimens themselves be referred to *Desmopteris* sp.

¹ Brongniart, 1828-37, pl. 83, fig. 1; pl. 133, fig. 2.

² Lindley & Hutton, 1831-33, pl. 60.

CALLIPTERIS Brongniart (1849)

(Dictionnaire Universel d'Histoire Naturelle, Vol. XIII, p. 73)

CALLIPTERIS sp.

(ALETHOPTERIS HYMENOPHYLLOIDES Lesquereux [pars])

Plate XVII, fig. 1

1870. *Alethopteris hymenophylloides* Lesquereux (pars), Geol. Survey of Illinois, Vol. IV, p. 393, pl. 10, fig. 1 (non figs. 2-4).
1874. *Alethopteris hymenophylloides* Lesquereux (pars). Schimper, *Traité de Paléont. Végétale*, Vol. III, p. 500.
1879-80. *Pseudopecopteris hymenophylloides* Lesquereux (pars), Coal Flora of Penn., Vol. I, p. 196, pl. 56, fig. 2 (non figs. 3-3b).
1913. *Alethopteris hymenophylloides* Lesquereux (pars). Franke in Potonié, *Abbild. und Beschreib. foss. Pflanz.*, Vol. IX, No. 177, p. 3.

Original Description of *Alethopteris hymenophylloides* Lesquereux:

The original description of this species has been given previously in connection with *Sphenopteris illinoisensis* D. White (page 55), and will not be repeated here. When establishing this species, Lesquereux used two cotypes which have since been considered as representing two distinct forms, one having been referred to *S. illinoisensis* D. White, and the other now being considered below.

Discussion:

The type specimen here under consideration was originally included by Lesquereux as a cotype of his species *Alethopteris hymenophylloides*. It was designated as figure 1, plate 10, of Volume IV of the report of the Geological Survey of Illinois. The specimen is indistinctly preserved, and the concretion in which it occurs was split in such a way that irregular fractures of the stone obliterate the edges of the pinnules. Some of the pinnules, however, show a margin that is slightly undulating. The venation is quite indistinct, but shows indications of widely arching lateral veinlets forking once, twice, or possibly more times. The specimen is quite similar to one pictured by Zeiller in his *Bassin Houiller et Permien de Brive*, fasc. 2, 1892, plate 8, figure 2, and identified as *Callipteris conferta* Sternberg var. *polymorpha* Sterzel. It is, however, too indistinct for definite reference to this species and variety.

Conclusion:

It is concluded that the portion of *Alethopteris hymenophylloides* Lesquereux here under consideration should be referred to *Callipteris* sp. without attempt at specific determination because of

the indistinct preservation of the specimen. Since the other portion of the original species has also been removed from its original classification (page 55), the original species name should be discarded.

ASTEROTHECA Presl (1845)

(In Corda, Flora Protogaea, Beiträge zur Flora de Vorwelt, 1867, p. 89)

ASTEROTHECA MILTONI Artis

(SPHENOPTERIS PAUPERCULA Lesquereux)

Plate XV, fig. 2

- 1825. *Filicites miltoni* Artis, Antediluvian Phytology, pl. 14.
- 1828. *Pecopteris miltoni* Artis. Brongniart, Prodrôme, p. 58.
- 1828. *Pecopteris miltoni* Artis. Brongniart, Histoire des Végétaux Fossiles, p. 333, pl. 114.
- 1866. *Sphenopteris paupercula* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 435, pl. 41, figs. 4-4a.
- 1869. *Sphenopteris paupercula* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. I, p. 380.
- 1877. *Hawlea miltoni* Artis. Stur, Die Culm-Flora, Vol. II, Part 8, p. 293.
- 1880. *Sphenopteris paupercula* Lesquereux, Coal Flora of Penn., Vol. I, p. 278.
- 1886. *Pecopteris miltoni* Artis. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 120.
- 1899. *Pecopteris (Asterotheca) miltoni* Artis. Zeiller, Flore Fossile du Bassin Houiller d'Héracle, p. 32.
- 1924. *Asterotheca miltoni* Artis. Kidston, Carboniferous Rocks of Great Britain, Vol. II, Part 5, p. 501, pl. 120, figs. 1-5; pl. 121; pl. 122, fig. 1.

Original Description of *Sphenopteris paupercula* Lesquereux:

Frond bipinnatifid; pinnae linear-lanceolate, apparently long, with a strong rachis; pinnules nearly equal, distant, oblong obtuse, somewhat decurrent by a narrowed base, and oblique on the rachis; margins equally sinuate, or nearly pinnately round lobed; medial nerve flat, broad, pinnately branching in each lobe; veins forking two or three times. Distantly related to *Pecopteris schoenleiniana* Brongniart, of the Keuper of Europe. Coal No. 3, St. John, Perry County, Illinois.

Discussion:

The type specimen here under consideration is very poorly preserved, and is inadequate for specific description. Lesquereux has pictured the uppermost pinnules of the pinna as being lobate, whereas those of the specimen itself seem to be more nearly entire with some irregularities apparently due to incomplete preservation. The lower pinnules are definitely lobate however. The venation is indistinct, but at such places where it can be observed (in the upper

pinnules) the lateral veins are seen to fork once, after which the upper bifurcating veinlet only divides a second time. Such venation is characteristic of *Asterotheca miltoni* Artis. Although Lesquereux has shown venation in the lobate pinnules of his drawing, this characteristic must have been inferred, since the actual specimen does not show it distinctly. The specimen, as a whole, appears to represent a somewhat aberrant form of *Asterotheca miltoni*. The pinnules are widely spaced upon a rather thick rachis. A somewhat similar specimen, with pinnules more closely spaced on a flexuous rachis has been pictured by Kidston in his Fossil Plants of the Carboniferous Rocks of Great Britain, Volume II, Part 5, plate 121, figure 3. This seems to be intermediate between the common forms of *A. miltoni* and Lesquereux's specimen. Thus is provided a link which seems to unite the latter with the typical forms. The specimen is definitely not a *Sphenopteris*.

Conclusion:

It is concluded that *Sphenopteris paupercula* Lesquereux does not represent a distinct species, and that the name should be discarded as invalid. The specimen is referred to *Asterotheca miltoni* Artis.

ASTEROTHECA SQUAMOSA Lesquereux

(PECOPTERIS SQUAMOSA Lesquereux)

Plate XVI

- 1870. *Pecopteris squamosa* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 400, pl. 12, figs. 1-4; pl. 13, figs. 10-11.
- 1874. *Pecopteris squamosa* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 496.
- 1879-80. *Pecopteris squamosa* Lesquereux, Coal Flora of Penn., Vol. I, p. 235, pl. 39, figs. 12-13.
- 1897-99. *Pecopteris (Asterotheca) squamosa* Lesquereux. D. White, U. S. G. S., 19th. Ann. Rept., Part 3, p. 494.
- 1899. *Pecopteris squamosa* Lesquereux. D. White, U. S. G. S. Monograph 37, p. 84.
- 1913. *Cheilanthes squamosus* Lesquereux. D. White, West Virginia Geol. Survey, Vol. V (A), Part 2, p. 395.
- 1925. *Pecopteris squamosa* Lesquereux. Noé, Illinois State Geol. Survey, Bulletin 52, pl. 30, fig. 3.
- 1939. *Pecopteris squamosa* Lesquereux. Janssen, Leaves and Stems from Fossil Forests, p. 122, figs. 103, 117c.

Original Description of *Pecopteris squamosa* Lesquereux:

Frond evidently bi- or tripinnately divided, triangular or lanceolate in outline, with a thick rachis, half an inch or more at its base, covered to the top of its last divisions with long, linear lanceolate pointed scales, either straight and adpressed to the stem, or open and diverging all around, even sometimes appearing as dried up and crumpled. The rachis of the last divisions is proportionately broad, and is either scaly or marked with crowded points indicating the base of the scales. Secondary pinnae long, linear, slightly tapering to an obtuse point, flexuous or curved upwards, bearing alternate, unequal, narrow linear, obtuse, oblong leaflets, nearly perpendicular to the rachis, reflexed on the borders, very close to each other, or often contiguous for their whole length, marked with a deep medial nerve, but no trace of veins. These leaflets, generally more or less irregular in their length, have their fructification indicated by small round dots, placed in two rows, close to the borders; the dots are numerous and distinct; their relation to the veins and veinlets is unknown. Colchester and Mazon Creek, Illinois.

Discussion:

This species, which is quite distinct because of the scaly, or squamose, character of its rachis and the unusually small size of the pinnae, has been very completely described by Lesquereux. His description needs emending only in respect to the venation, which was stated to be obsolete. White¹ has pointed out that, in cases where lateral venation is observable, the veinlets are distant, simple, or forked once. Except for the scaly rachis, the species is closely similar to *Asterotheca arborescens* Schlotheim. White has also called attention to the fact that the fructification is of the *Asterotheca* type,² thereby allowing removal to this genus.

Conclusion:

It is concluded that *Asterotheca squamosa* Lesquereux represents a distinct species and should be retained.

CROSSOTHECA Zeiller (1883)

(Annales des Sciences Naturelles, Serie 6, Botanique, Vol. XVI, p. 180)

CROSSOTHECA SAGITTATA Lesquereux

(STAPHYLOPTERIS SAGITTATUS Lesquereux)

Plate XVII, fig. 2

1870. *Staphylopteris sagittatus* Lesquereux. Geol. Survey of Illinois, Vol. IV, p. 407, pl. 14, figs. 3-5.
 1870. *Pecopteris abbreviata* Brongniart. Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 403.

¹ D. White, 1899, p. 84.

² D. White, 1897-99, p. 494.

1874. *Staphylopteris sagittata* Lesquereux. Schimper, *Traité de Paléont. Végétale*, Vol. III, p. 513.
- 1879-80. *Pecopteris abbreviata* (?) Brongniart. Lesquereux, *Coal Flora of Penn.*, Vol. I, p. 248, pl. 46, figs. 4-6.
- 1879-84. *Sorocladus sagittatus* Lesquereux, *Coal Flora of Penn.*, Vol. I, p. 329, pl. 48, figs. 10-10b; Vol. III, p. 760, pl. 100, figs. 4-5.
1888. *Sorocladus sagittatus* Lesquereux. Zeiller, *Valenciennes*, p. 117.
1899. *Sorocladus sagittatus* Lesquereux. D. White, *U. S. G. S. Monograph* 37, pp. 62-63.
1902. *Crossotheca sagittata* Lesquereux. Sellards, *Amer. Jour. Science*, Vol. XIV, p. 196, pl. 7, figs. 1-3c, 8.
1913. *Crossotheca sagittata* Lesquereux. Carpentier, *Mémoires Soc. géol. du Nord*, Vol. VII, p. 381, pl. 9, fig. 7.
1923. *Crossotheca sagittata* Lesquereux. Kidston, *Carboniferous Rocks of Great Britain*, Vol. II, Part 4, p. 350, pl. 87, fig. 3.
1935. *Crossotheca sagittata* Lesquereux. Darrah, *Recent Studies of American Pteridosperms*, p. 134, pl. 4, figs. 1a-b.
1937. *Crossotheca sagittata* Lesquereux. Darrah, *Codonotheca and Crossotheca*, *Botanical Museum Leaflets, Harvard Univ.*, Vol. IV, No. 9, pp. 153-172.
1939. *Crossotheca sagittata* Lesquereux. Janssen, *Leaves and Stems from Fossil Forests*, p. 140, figs. 117m, 124, 125.

Original Description of *Staphylopteris sagittatus* Lesquereux:

Frond bipinnate, divisions alternate; secondary rachis thick, decurrent on main stem which is also broad and smooth. The double celled sporanges are linear, attached by their backs, and pressed against each other in horizontal rows. The enlarged pedicel of the sporange cells is, before maturity, apparently at least, folded in the middle, and both rows of sporanges are joined together by their back, forming in that state slightly scythe-shaped cylinders, obtuse at both ends, attached to the pedicel by a dorsal membrane, and marked all around by the ring-like outlines of sporanges. More generally the sporange-cells are open side by side on each side of the dorsal support, and the sporanges appear then in two convex rows. In some specimens on concretions the sori or sporange bearing cells are deeply immersed in the stone, generally leaving around them an empty space. No traces of leaflets have been seen in connection with the species. Mazon Creek, Illinois.

Discussion:

When first described, the dimorphic nature of this species was not apparent. Later, in Volume III of his *Coal Flora of Pennsylvania*, Lesquereux pictured a specimen bearing both fertile and sterile pinnules. Sterile pinnules, originally dubiously referred to *Pecopteris abbreviata* Brongniart by Lesquereux, were thus shown to belong to *Staphylopteris sagittata*. In the meantime, Lesquereux had instituted a new genus, *Sorocladus*, for the reception of this species inasmuch as objections had been raised to the use of *Staphylopteris* Presl, a Tertiary genus.¹ In 1899 David White recognized that the

¹ Lesquereux, 1880, p. 327.

fructification of this species was of the type *Crossotheca* Zeiller, and in 1902 Sellards definitely referred it to the latter genus.

As a result of Sellards' work, the nature of *Crossotheca sagittata* is much better known. The sterile pinnules, when present, occur in the extreme apical portion of the frond. In many instances the entire frond appears to consist of fertile pinnules. Sellards¹ describes the sterile pinnules as being small, rounded, close, oblique, connate, and decurrent at the base, the smaller entire, the larger becoming lobate. The ultimate pinnae are broadly linear-lanceolate, alternate, oblique, close, or touching. The midrib is broad, shallow, and decurrent; lateral veins curve regularly to the border, forking one to three times according to the size of the pinnule. The large fertile pinnules are sagittate, the smaller ones only slightly so. All have a rather prominent foot-stalk. The flat, upper surface of the pinnule has a distinct median line, with the lateral veins obscured. The sporangia are $2\frac{1}{2}$ to 4 millimeters long, and $\frac{1}{2}$ to $\frac{3}{4}$ millimeters wide. They occur in a single row around the border of the pinnules, and are often seen to be filled with spores. The spores are quite large, measuring from .056 to .060 millimeters in diameter, and are marked at the apex by three distinct radiating lines.

Conclusion:

It is concluded that *Crossotheca sagittata* Lesquereux, as emended by Sellards, should stand as a valid species.

SOROCLADUS Lesquereux (1880) (Coal Flora of Pennsylvania, Vol. I, p. 327)

SOROCLADUS WORTHENI Lesquereux (STAPHYLOPTERIS WORTHENII Lesquereux)

Plate XVIII, fig. 3

- 1870. *Staphylopteris worthenii* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 405, pl. 14, figs. 1-2b.
- 1874. *Staphylopteris worthenii* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. III, p. 512.
- 1880. *Sorocladus worthenii* Lesquereux, Coal Flora of Penn., Vol. I, p. 330.

Original Description of *Staphylopteris worthenii* Lesquereux:

Frond bipinnate, ovate lanceolate in outline; pinnae linear, gradually tapering to an obtuse point, short, one inch long near the base of the frond, scarcely half an inch near the top, perpendicular to the main rachis; pinnules alternate,

¹ Sellards, 1902, p. 197.

triangular, formed of an agglomeration of three or five sori apparently attached to a main pedicel, but without trace of leaves. Main rachis thick, three lines at its base, finely irregularly striate, the branches or pinnae appearing attached rather upon it or around it than along its borders; the rachis of the branches is also thick, smooth, and on both sides of it are attached the groups of sori, three to five in number, in a kind of pyramidal position, with a thick short pedicel in the middle. The sori, when unopened, are round, marked on the flattened surface by four or five lines diverging from the center to the circumference. When opened the sporanges appear placed like the rays of a star around a central point. These sporanges, oval, elongated or gradually enlarged outwards from the narrow point of attachment, deeply concave, finely striate within, are all turned to the same side, viz: they point downwards and the branches tending obliquely upwards; in that way the upper sori of the pinnae have the point towards the rachis, while in the lower ones it is turned from it. The sporanges are deeply marked or excavated in the stone, which is still more deeply penetrated by the point, and this point appears, as said above, to have been attached to a common pedicel by filaments now destroyed. Mazon Creek, Illinois.

Discussion:

In repeating the description of this species in his Coal Flora of Pennsylvania, Lesquereux adds: "It is not possible to have an exact idea of the relation of the sporanges to the pinnae as no trace of a pedicel can be seen. They appear as sessile upon the secondary rachis." This would seem to contradict his earlier description that a short, thick pedicel appears in the middle of the group of sporangia.

A careful inspection of the type specimen discloses no characters which are sufficiently diagnostic to describe properly the form of the sporangia. None of the original plant material, or carbon, is preserved, and the imperfect cavities, or impressions, of the original sori are more or less filled with white calcareous material which does not show the original plant structure. The impressions as seen in the stone resemble, in a general way, the drawings made and pictured by Lesquereux in his Atlas of the Coal Flora. The drawings, however, exhibit much more detail and perfection than can actually be observed on the specimen itself. So far as known, no other specimens of this particular form have ever been recognized, and it seems futile to attempt any further classification based upon such poorly preserved material.

Conclusion:

It is concluded that *Sorocladus wortheni* Lesquereux cannot be referred definitely to any other known fructification, nor is it sufficiently well preserved to be accurately described beyond the attempts made by Lesquereux. Under such circumstances it would seem advisable to allow the species to stand for the present with the hope

that better preserved specimens may be found in the future, thereby shedding more light on the nature of this particular form.

SPIROPTERIS Schimper (1869)

(Traité de Paléontologie Végétale, Vol. I, p. 688)

SPIROPTERIS UNCINNATA Lesquereux

(SELAGINITES UNCINNATUS Lesquereux)

Plate XVII, fig. 3

1851. ——— Bunbury, Description of a peculiar Fossil Fern from the Sydney Coal Field, Cape Breton, Quart. Jour. Geol. Soc. Amer., Vol. VIII, p. 31, pl. 1.
1866. *Selaginites uncinnatus* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 446, pl. 41, fig. 3.
- 1869-74. *Spiropteris* Schimper, Traité de Paléont. Végétale, Vol. I, p. 688, pl. 49, fig. 1.
1869. *Rhizomopteris filiformis* Schimper, Traité de Paléont. Végétale, Vol. I, p. 700.
1880. *Lycopodites uncinnatus* Lesquereux, Coal Flora of Penn., Vol. II, p. 359.
1900. (?) *Lycopodites uncinnatus* Schimper. D. White, U. S. G. S. 20th. Ann. Rept., Vol. II, p. 825.
1932. *Selaginites uncinnatus* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 18, p. 714.

Original Description of *Selaginites uncinnatus* Lesquereux:

The only specimen seen of this species evidently represents a plant of the *Lycopodiaceae*, with a slender, irregular forking stem, covered with short acicular, numerous leaves, mostly perpendicular to the stem, apparently not enlarged at the base. On the branches the leaves appear shorter, more erect and imbricated. The small and latest branches, in their unfolding, have the same spiral disposition as some *Lycopodiaceae* and the Ferns. This species is distantly related to *Selaginites erdmanni* Germar. Coal No. 3, Colchester, Illinois.

Discussion:

Although correctly describing the appearance of this form, Lesquereux seems to have undervalued its fern-like characteristics as evidenced by several closely coiled tips. His illustration also merely suggests the presence of these coils, and does not show the detail which is clearly visible on the type specimen. The specimen is very similar to an unnamed fern from Cape Breton, described by Bunbury,¹ and later included in the genus *Spiropteris* as established by Schimper.² The dimorphic nature of the plant, as evidenced by its two kinds of leaves, may be cause for speculation as to its possible

¹ Bunbury, 1851, p. 31.

² Schimper, 1869, p. 688.

phylogeny. Dimorphism is known to be a definite characteristic of some ferns in which reduced leaves, or scales, occur upon the rachis. In this respect, the specimen under consideration is comparable to *Asterotheca squamosa* Lesquereux, which has very much shorter scales upon its rachis. It is interesting to note that Bunbury¹ has called attention to the close relationship of the lycopods and ferns, and suggested that his specimen might represent a form which combines certain characteristics of both.

Conclusion:

It is concluded that *Selaginites uncinnatus* Lesquereux does not belong to the *Lycopodiales*, but is referable instead to the *Filicales*. As the nature of its fructification is unknown, and the pinnules of the uncoiling pinnae are too small to be specifically determined, it appears unwise to place this species elsewhere than in the genus *Spiropteris* Schimper. In addition, the scale-like leaves upon the rachis provide no specific index. Since neither Bunbury nor Schimper applied a specific name to the Cape Breton specimen, the specific name, *uncinnatus*, of Lesquereux remains valid. Consequently the species becomes *Spiropteris uncinnata* Lesquereux.

MEGAPHYTON Artis (1825)

(Antediluvian Phytology, p. 20)

MEGAPHYTON FRONDOSUM Artis

(MEGAPHYTUM PROTUBERANS Lesquereux)

Plate XIX, fig. 3

- 1825. *Megaphyton frondosum* Artis, Antediluvian Phytology, p. 20, pl. 20.
- 1834. *Megaphyton distans* Lindley & Hutton, Fossil Flora of Great Britain, Vol. II, pl. 117.
- 1855. *Megaphytum frondosum* Artis. Geinitz, Verstein. der Steink. in Sachsen, p. 32, pl. 35, fig. 10.
- 1866. *Megaphytum protuberans* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 458, pl. 47, figs. 1-2.
- 1869. *Megaphytum protuberans* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. I, p. 714.
- 1880. *Megaphytum protuberans* Lesquereux, Coal Flora of Penn., Vol. I, p. 352.
- 1883-84. *Megaphytum protuberans* Lesquereux, Indiana Dept. Geol. and Nat. Hist., Part 2, p. 75, pl. 8, fig. 11.
- 1886. *Megaphyton frondosum* Artis. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 143.

¹ Bunbury, 1851, p. 31.

1931. *Megaphytum frondosum* Artis. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 119.
1931. *Megaphytum protuberans* Lesquereux. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 125.

Original Description of *Megaphytum protuberans* Lesquereux:

Scars convex, elevated, square-oval, slightly emarginate above, marked in the upper part by vascular lines of nearly the form of a reversed horse-shoe; stem irregularly striated and pointed; points of various size, and placed without apparent order. Below the upper Chester limestone at Carroll's Place, Pope County, Illinois.

Discussion:

Only one of Lesquereux's cotypes of this species was available for this study, and is the one designated as figure 1, plate 47, of Volume II of the report of the Geological Survey of Illinois. It is a sandstone cast 25 inches long, bearing a single row of closely placed petiole scars each about $2\frac{1}{2}$ inches high by 2 inches in width. The species was pictured and described by Lesquereux in an upside position, and allowance must be made for this when considering the original description.

The specimen is almost identical in general appearance and proportions to that of *Megaphyton frondosum* as pictured by Artis in his Antediluvian Phytology, plate 20. Lesquereux's specimen is somewhat better preserved, however, and shows quite clearly the horse-shoe shapes of several of the scars. This similarity was noted by Lesquereux in his Coal Flora of Pennsylvania, page 352, but he nevertheless retained it as a distinct species. An examination of the specimen indicates that there is no essential difference between *M. protuberans* Lesquereux and *M. frondosum* Artis, the original description of which is quoted as follows: "Cicatrices near together, horse-shoe shaped with the point upwards, filling the furrow."¹

Conclusion:

It is concluded that *Megaphytum protuberans* Lesquereux does not constitute a distinct species and should be discarded as invalid. The specimen is referred to *Megaphyton frondosum* Artis.

¹ Artis, 1825, p. 20.

MEGAPHYTON APPROXIMATUM Lindley & Hutton

(MEGAPHYTUM McLAYI Lesquereux)

Plate XX

1834. *Megaphyton approximatum* Lindley & Hutton, Fossil Flora of Great Britain, Vol. II, pl. 116.
1860. *Megaphyton goldenbergi* Weiss, Zeitschrift der Deutschen geol. Gesellschaft, Vol. XII, p. 509.
1866. *Megaphytum McLayi* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 458, pl. 48.
1869. *Megaphytum approximatum* Lindley & Hutton. Schimper, Traité de Paléont. Végétale, Vol. I, p. 713.
- 1869-74. *Megaphytum goldenbergii* Weiss. Schimper, Traité de Paléont. Végétale, Vol. I, p. 713, pl. 54, figs. 1-2.
1877. *Megaphytum M'Layi* Lesquereux, vel *goldenbergii* Weiss. Grand'Eury, Flore Carbonifère du Dept. Loire, p. 83.
- 1879-80. *Megaphytum goldenbergii* Weiss. Lesquereux, Coal Flora of Penn., Vol. I, p. 349, pl. 61, fig. 4.
1880. *Megaphytum McLayi* Lesquereux, Coal Flora of Penn., Vol. I, p. 349.
1882. *Megaphytum goldenbergi* Weiss, Flora der Steinkohlenformation, p. 19, fig. 112.
1883. *Megaphytum McLayi* Lesquereux. Renault, Cours de Botanique Fossile, Vol. III, p. 140, pl. 24, fig. 1.
1886. *Megaphyton frondosum* Artis (pars). Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 143.
- 1886-88. *Megaphyton approximatum* Lindley & Hutton. Zeiller, Valenciennes, p. 310, pl. 52, fig. 1.
1899. *Megaphyton goldenbergi* Weiss. D. White, U. S. G. S. Monograph 37, p. 102.
1910. *Megaphyton McLayi* Lesquereux. Seward, Fossil Plants, Vol. II, p. 422.
1921. *Megaphyton McLayi* Lesquereux. Potonié & Gothan, Lehrbuch der Paläobotanik, p. 108, fig. 100.
1923. *Megaphyton McLayi* Lesquereux. Gürich, Leitfossilien, p. 89, fig. 81a.
1926. *Megaphyton McLayi* Lesquereux. Bertrand, Conférences de Paléobotanique, p. 63.
1927. *Megaphyton approximatum* Lindley & Hutton. Hirmer, Handbuch der Paläobotanik, p. 569.
1931. *Megaphytum approximatum* Lindley & Hutton. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 117.
1931. *Megaphytum goldenbergi* Weiss. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 121.
1931. *Megaphytum Mac'Layi* Lesquereux. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 123.

Original Description of *Megaphytum McLayi* Lesquereux:

Scars very large, nearly contiguous, flattened, surrounded by a broad, smooth margin, broadly square, somewhat rounded, separated in two by a broad,

irregular rib, and marked on both sides by irregular auriculate impressions of the ducts. St. John, Illinois.

Discussion:

Megaphyton McLayi Lesquereux has been considered as a distinct species by many authors; and by others it has been compared, or actually referred, to *M. goldenbergi* Weiss. Furthermore, the distinction between *M. goldenbergi* and *M. approximatum* Lindley & Hutton has been questioned at various times. Kidston¹ refers all of these species to *M. frondosum* Artis on the grounds that they merely represent different ages and states of preservation of the same plant.

Since there is apparently a considerable difference of opinion among authors as to the relationship of these species, a comparison was made of the several forms as described and pictured by the respective authors, and these, in turn, were compared with Lesquereux's type specimen. No distinct line could be drawn between *M. approximatum*, *M. goldenbergi*, and *M. McLayi*. The characteristics of each seem to be proportionately similar, allowing for minor differences due to age and state of preservation, thus bearing out Kidston's contentions. The present study, however, does not allow the reference of these forms to *M. frondosum* Artis. A marked difference seems to exist between the latter species and the *M. approximatum* group on the basis of the proportionate width to height of the petiole scars. The scars of *M. approximatum* and its related forms are closely adjacent upon the stem, and are always wider than they are high. The height in all cases is approximately two-thirds that of the width of the respective scars. On the other hand, *M. frondosum* has scars which appear to be placed farther apart because they are always higher than wide. The ratio in this species is a width of approximately two-thirds that of the height of the respective scars. On this basis, *M. goldenbergi* Weiss and *M. McLayi* Lesquereux are referable to *M. approximatum* Lindley & Hutton since the latter name has priority. *M. frondosum* Artis is here considered a distinct species since it has scars of a proportionately different shape. In this connection, it should be noted that *M. distans* Lindley & Hutton was admitted by the originators to be identical with *M. frondosum* Artis, the name having been changed by them on invalid grounds.²

¹ Kidston, 1886 (a), p. 143.

² Lindley & Hutton, 1834, Vol. II, p. 92; Kidston, 1886 (a), remarks at foot of p. 143.

The generic name has been spelled differently by various authors, but since the form "*Megaphyton*" has priority, it seems advisable to use this spelling.

Conclusion:

It is concluded that *Megaphytum McLayi* Lesquereux does not represent a distinct species, and should be discarded as a valid type. The specimen is referred to *Megaphyton approximatum* Lindley & Hutton.

MEGAPHYTON INSIGNIS Lesquereux

(CAULOPTERIS INSIGNIS Lesquereux)

Plate XXI

- 1866. *Caulopteris insignis* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 459, pl. 49, fig. 1.
- 1869. *Stemmatopteris insignis* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. I, p. 710.
- 1872. *Stemmatopteris insignis* Lesquereux. Carruthers, Geological Magazine, Vol. IX, p. 466.
- 1879-80. *Stemmatopteris insignis* Lesquereux, Coal Flora of Penn., Vol. I, p. 340, pl. 59, fig. 7.
- 1890. *Megaphyton insigne* Grand'Eury, Géol. et Paléont. du Gard, p. 281, pl. 18, fig. 1.
- 1910. *Megaphyton insigne*. Seward, Fossil Plants, Vol. II, p. 421, fig. 298B.
- 1931. *Caulopteris insignis* Lesquereux. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 82.
- 1931. *Stemmatopteris insignis* Schimper. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 205.
- 1931. *Megaphytum insigne* Grand'Eury. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 122.

Original Description of *Caulopteris insignis* Lesquereux:

Scars very large, exactly oval, bordered by a smooth, broad (about one inch) annulus. Vascular scars horse-shoe shaped, with the internal branches descending nearly to the basal line, where they unite in a point, forming a spatulate, pointed or beaked medial rib, with two at first parallel and then diverging semilunar appendages; surface smooth, except the rib which is marked by irregular, deep points in its whole length, and in the space between the appendages. Lower Coal Measures, Duquoin, Illinois.

Discussion:

The type specimen is described correctly by Lesquereux except as to the width of the annulus, or bordering ring, of the scar. Actually this averages a half inch in width instead of one inch. The scar

has an average height of $4\frac{3}{4}$ inches, and width of $3\frac{1}{2}$ inches. In general shape, it resembles a horse-shoe more closely than do either *Megaphyton frondosum* Artis or *M. approximatum* Lindley & Hutton. The central "rib," or sinus, is quite distinct, and suggests the aspect of a track made by the cloven hoof of an artiodactyloid mammal.

The proportions of width to height, together with the deep medial sinus of the scar, definitely preclude its reference to the aforementioned species. Unfortunately, there is only a single scar known, and absolute evidence as to the arrangement of the scars upon the stem is lacking. The great size of the scar and its very definite horse-shoe shape indicate an affinity to *Megaphyton* Artis rather than to *Caulopteris* Lindley & Hutton. Had such scars been arranged in spirally ascending order, the stem would have been vastly more massive than any known tree-fern thus far discovered. It seems more likely, therefore, that scars of this size were limited to the *Megaphyton* form wherein they were arranged in two vertical rows on opposite sides of the stem.

Conclusion:

It is concluded that *Caulopteris insignis* Lesquereux represents a distinct form, and should be retained as a valid species. It is, however, transferred to the genus *Megaphyton* Artis.

CAULOPTERIS Lindley & Hutton (1832)

(Fossil Flora of Great Britain, Vol. I, pl. 42)

CAULOPTERIS RADICANS Lesquereux

(LEPIDODENDRON RADICANS Lesquereux)

Plate XXII

- 1866. *Lepidodendron radicans* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 454, pl. 46, fig. 1.
- 1870. *Lepidodendron radicans* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. II, p. 28.
- 1880. *Lepidodendron radicans* Lesquereux, Coal Flora of Penn., Vol. II, p. 397.
- 1886. (?) *Caulopteris peltigera* Brongniart. Kidston, Catalogue of Palaeozoic Plants in the British Museum, pp. 146, 147.
- 1904. *Aspidiaria* sp. Presl. Fischer, Abhandl. K. Preuss. Geol. Landes., N. F. 39, p. 61.
- 1905. *Aspidiaria* sp. Presl. Fischer in Potonié, Abbild. und Beschreib. foss. Pflanz., Vol. III, No. 43, p. 2.

1929. *Lepidodendron radicans* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 15, p. 268.

Original Description of *Lepidodendron radicans* Lesquereux:

Cicatrices large, irregularly oval, very obtuse on the sides, pointed or somewhat narrowed and continuous at both ends; vascular scars central, generally eccentric on one side of the cicatrices; obliterated by irregular, deep, large striae or narrow ribs, apparently the marks of flattened rootlets. The species has some relation with *Caulopteris macrodiscus* Sternberg, but in one specimen the scars are continuous and have the spiral portion of the cicatrices of *Lepidodendron*. Duquoin, Illinois.

Discussion:

In discussing this species, both in the Illinois Survey report and the Coal Flora of Pennsylvania, Lesquereux suggests its possible relationship to *Caulopteris macrodiscus* Sternberg. and *C. mansfieldi* Lesquereux. Except for the larger size of its scars, the specimen also has a relatively close similarity to *C. voltzi* Schimper & Mougeot.¹ Kidston² considers it referable to *C. peltigera* Brongniart with which he also unites *C. macrodiscus*. Schimper, Jongmans, and Fischer consider it referable to decorticated *Lepidodendra*. They, however, had no opportunity to examine the type specimen itself, their judgment undoubtedly having been influenced by the poorly drawn illustration of Lesquereux.

An examination of the specimen quite clearly shows it to be a tree-fern stem and not a *Lepidodendron*. It differs from all of the above mentioned species of *Caulopteris* in not having the petiole scar outlines clearly defined. On the contrary, the entire scar areas are composed of more or less concentric undulating striae. Near the center of each scar area may be seen the point of attachment of the vascular bundles, but these, too, are nearly obscured by the striations. Since the exact limits of the petiole scars cannot be defined, it seems inadvisable to refer the specimen to any of the previously known species. In addition, because of the apparently closely crowded arrangement of the scars, it is possible that the specimen may actually represent a distinct form.

Conclusion:

It is concluded that *Lepidodendron radicans* Lesquereux is a tree-fern stem belonging to the genus *Caulopteris* Lindley & Hutton. Since its specific characters do not agree definitely with previously

¹ Schimper & Mougeot, 1844, p. 65, pls. 30, 31; also Schimper, 1874, pl. 51, fig. 2.

² Kidston, 1886 (a), pp. 146, 147.

described species, it is permitted to remain, at least for the present, as a valid type in its own name, *Caulopteris radicans* Lesquereux.

CAULOPTERIS WORTHENI Lesquereux

Plate XVIII, fig. 4

- 1866. *Caulopteris wortheni* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 459, pl. 50, figs. 1-1c.
- 1869. *Stemmatopteris wortheni* Lesquereux. Schimper, Traité de Paléont. Végétale, Vol. I, p. 711.
- 1880. *Stemmatopteris wortheni* Lesquereux, Coal Flora of Penn., Vol. I, p. 342.
- 1931. *Stemmatopteris wortheni* Schimper. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 207.

Original Description of *Caulopteris wortheni* Lesquereux:

Stems slender, about three inches in diameter, somewhat compressed; scars distant, round at the base, narrowed, horse-shoe shaped above, with converging branches; vascular scars of the same form as the annules, marked near the base by a semi-lunar obscure appendage. The specimen figured here is replaced by sandstone. It appears to be decorticated; at least the surface is perfectly smooth. Carmi, Illinois.

Discussion:

The type specimen, which is about thirteen inches long, is unique in that throughout this section of stem only two petiole scars are visible. Lesquereux claimed that four are present,¹ but a close examination of the specimen does not disclose the other two. The two visible scars are each about four centimeters long, and about two centimeters wide at their widest points. They are more nearly linear-ovate in general shape, rather than horse-shoe shaped. They are spirally arranged in such a manner as to indicate a tricunxial system of arrangement, i. e., the two visible scars are not on opposite sides of the stem as in *Megaphyton*, but are separated horizontally by a distance equal to about one-third the circumference of the stem. If a third scar were visible it ought to occupy a position corresponding to the remaining one-third of the circumference, thus completing the tricunxial scheme. The position on the cast where the third scar might be expected is occupied instead by a deep collapse-fold, obscuring any possible scar which might have been present there. The vertical distance between the scar positions is about four centimeters, or equal to the length of the scars themselves. The remainder of the surface, as Lesquereux has stated, is quite smooth.

¹ Lesquereux, 1880, p. 342.

Although it is quite possible that the petiole scars were arranged in a tricunxial scheme, as indicated above, it might be equally possible for them to have been more or less irregularly arranged at varying distances in ascending order about the stem. In any event, they were spirally, but not biserially, arranged.

This species was later removed to the genus *Stemmatopteris* Corda by Schimper, apparently upon insufficient evidence. The various genera of tree-fern stems established by Corda,¹ namely, *Zippea*, *Protopteris*, *Sphalmopteris*, *Chelepteris*, *Stemmatopteris*, *Ptychopteris*, along with *Caulopteris* Lindley & Hutton, and *Cottaeta* Goepfert, are based on minor differences and degrees of decortication. These are not only confusing, but are also unobservable on many casts and impressions. Several of these have been united by Hirmer² under the genus *Caulopteris* Lindley & Hutton which has come to be a collective genus for the inclusion of various spirally arranged stems of tree ferns. Because of its uncertain relationship, the species here under consideration, should be returned to the genus *Caulopteris*.

Caulopteris obtecta Lesquereux, described in Volume IV of the Geological Survey of Illinois, page 457, plate 28, may also be referable to this species. It was not available, however, for the present study.

Conclusion:

It is concluded that the apparently peculiar arrangement of the petiole scars on the stem of *Caulopteris wortheni* Lesquereux establishes it as a distinct form, and for the present, at least, should be retained as a valid species.

CAULOPTERIS sp.

(CAULOPTERIS ACANTOPHORA Lesquereux)

Plates XXIII; XXIV, fig. 2

- 1870. *Caulopteris acantophora* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 458, pl. 26, figs. 3-4.
- 1880. *Ulodendron punctatum* Lindley & Hutton. Lesquereux, Coal Flora of Penn., Vol. II, p. 405 (syn. only).
- 1899. *Caulopteris* ? *acantophora* Lesquereux. D. White, U. S. G. S. Monograph 37, p. 102.
- 1931. *Caulopteris acanthophora* Lesquereux. Posthumus, Catalogue of Fossil Fern Stems and Petioles, p. 74.

¹ Corda, 1867, p. 76.

² Hirmer, 1927, p. 569.

Original Description of *Caulopteris acantophora* Lesquereux:

The species is represented by numerous specimens, some of them of large size, all of the same appearance. Their surface, either naked or coated with a pellicle of thin coaly matter, is marked by irregular elevated points, placed without regular order, evidently the basilar scars of spines, with which the branches or stems were covered. On the large specimens no trace of branch scars was discernable, but an oval line running parallel to a broad depression seen at the corner of the figure. It is a kind of deep convexity in the shale, with smooth, irregular borders, resembling rather the impression left by the sides of a nodule than a branch scar. A branch of this species has the same kind of cicatrices exactly on the surface, and still bears on its borders some of the hooked spines by which they are produced. The branch is attenuated into a conical point of attachment which does not resemble that of a branch of *Caulopteris*, and is also marked in the middle by a scar which, per contra, has the form of the branch scars of a fern. These specimens, all flattened, are therefore probably only referable to this genus. Colchester and Morris, Illinois.

Discussion:

Two cotypes were figured by Lesquereux, both of which are merely fragments showing numerous, small, punctate scars of former adventitious rootlets. Lesquereux has pictured the smaller specimen as having small, sharply pointed spines along its sides. An examination of the specimen itself indicates that such spines do not actually exist, and that Lesquereux received the false notion of their existence from fracture marks in the shale. This error was noted by David White in his Coal Flora of Missouri.¹ An imperfect impression of a petiole scar does exist, however, at one side of the specimen. The specimens undoubtedly represent fragments of the impressions of tree-fern stems, but are too incomplete for specific identification.

The genus *Caulopteris* was established by Lindley & Hutton for the inclusion of tree-fern stems having spirally arranged, circular, or oval scars. They gave no separate generic description. The first formal description of the genus was made by Corda,² and is translated as follows: "Stem arborescent, cylindrical, protruding scars originating from the foliar insertions. Scars spirally arranged, oblong, full of irregularly crowded vascular bundles." The genus includes impressions of the stem surfaces, and differs from *Psaronius* Cotta which was established for stems showing internal features in cross-section. Posthumus³ has pointed out that *Caulopteris* has come to be used in a very broad sense as a collective genus for all kinds of stems with uncertain affinities. *Caulopteris*, which has spi-

¹ D. White, 1899, p. 102.

² Corda, 1867, p. 76.

³ Posthumus, 1931, p. 74.

rally arranged scars, should not be confused with *Megaphyton* Artis which is limited to stems having the scars arranged in two longitudinal rows on opposite sides of the stems. Both genera may also have the very small punctate scars of adventitious rootlets which occurred on parts of the stems close to the ground.

Because of their fragmentary condition, the specimens here under consideration do not show sufficient characteristics to place them definitely in either generic group upon the basis of scar arrangement. Therefore they must remain in the genus *Caulopteris* which has become the collective genus for such stems of uncertain affinity.

Conclusion:

It is concluded that *Caulopteris acantophora* Lesquereux does not constitute a distinct species, and should be discarded as a valid type. The specimens are therefore referred to *Caulopteris* sp.

TRIGONOCARPUS Brongniart (1828)

(Prodrome d'une Histoire des Végétaux Fossiles, p. 137)

TRIGONOCARPUS PARKINSONI Brongniart

(TRIGONOCARPUM ROSTELLATUM Lesquereux)

Plate XVIII, fig. 2

- 1811. ——— Parkinson, Organic Remains, Vol. I, pl. 7, figs. 6-8.
- 1828. *Trigonocarpum parkinsoni* Brongniart, Prodrome, p. 137.
- 1833-37. *Trigonocarpum noeggerathi* Lindley & Hutton, Fossil Flora of Great Britain, Vol. II, pl. 142, C; Vol. III, pl. 193, B; pl. 222, figs. 2, 4.
- 1837. *Trigonocarpum olivaeforme* Lindley & Hutton, Fossil Flora of Great Britain, Vol. III, pl. 222, figs. 1, 3.
- 1866. *Trigonocarpum rostellatum* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 460, pl. 46, fig. 6.
- 1866. (?) *Carpolithes fasciculatus* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 461, pl. 46, fig. 7.
- 1870-72. *Trigonocarpus parkinsoni* Brongniart. Schimper, Traité de Paléont. Végétale, Vol. II, p. 214.
- 1877. *Trigonocarpus parkinsoni* Brongniart. Grand'Eury, Flore Carbonifère du Dépt. de la Loire, p. 183.
- 1879-80. (?) *Trigonocarpus parkinsoni* Brongniart. Lesquereux, Coal Flora of Penn., Vol. II, p. 589, pl. 85, figs. 9-10.
- 1880. *Carpolithes fasciculatus* Lesquereux, Coal Flora of Penn., Vol. II, p. 594 (syn.).
- 1886. *Trigonocarpum rostellatum* Lesquereux. Kidston, Catalogue of Palaeozoic Plants in the British Museum, p. 218.
- 1917. *Trigonocarpus parkinsoni* Brongniart. Seward, Fossil Plants, Vol. III, p. 119.

Original Description of *Trigonocarpum rostellatum* Lesquereux:

Fruit oval, a little flattened, three ribbed only near the point, which is curved in a short beak; lower part of the fruit round and smooth. Upper Coal Measures, Grayville, White County, Illinois.

Discussion:

Except for very minor disfiguration resulting from mode of preservation, the specimen called *Trigonocarpum rostellatum* by Lesquereux, is almost identical in size, shape, and surface characteristics to a seed pictured, but unnamed, by Parkinson in his *Organic Remains*, published in 1811. This specimen was later named *Trigonocarpum parkinsoni* by Brongniart in his *Prodrome* in 1828, but the illustration was not repeated. A similar, but larger, seed was pictured by Sternberg¹ under the name *Palmacites noeggerathi* in 1825. Some writers unite the two species, and in such a case the name used by Sternberg would have priority. Because of the considerable difference in size, it seems more desirable to retain them as distinct forms. Parkinson's specimen measures approximately 1 cm. in width by 2 cm. in length. Sternberg's is 1½ cm. wide and 3 cm. long. Lesquereux's specimen is 1½ cm. wide and 2 cm. long. It has been squeezed and flattened, however, so that its width, as preserved, is ½ cm. greater than its normal diameter. Actually, its dimensions would be the same as those of *T. parkinsoni*.

Lesquereux has stated that his specimen is three-ribbed near the point only, but this is untrue. The seed was imbedded in a piece of sandstone so that only a portion of the surface was visible. The single rib which was exposed to view has been partially obliterated as a result of fossilization, and this caused Lesquereux to believe that the rib was discontinuous. During the present study the seed was entirely removed from its enclosing matrix, thereby exposing the two other ribs which can now be seen to extend the entire length of the seed. The specimen has, without doubt, the same form as the one originally pictured by Parkinson.

Conclusion:

It is concluded that *Trigonocarpum rostellatum* Lesquereux is identical with *Trigonocarpus parkinsoni* Brongniart as originally figured by Parkinson. Lesquereux's name is consequently invalid, and the specimen therefore is referred to the prior species, *T. parkinsoni* Brongniart.

¹ Sternberg, 1825, fasc. 4, p. XXXV, pl. 55, figs. 6-7.

TRIGONOCARPUS DUBIUS Sternberg
(TRIGONOCARPUM JUGLANS Lesquereux)

Plate XVIII, fig. 1

1825. *Palmacites dubius* Sternberg, Versuch der Flora der Vorwelt, Vol. I. fasc. 4, tentamen, p. XXXV, pl. 58, figs. 3a-d.
 1828. *Trigonocarpum dubium* Sternberg. Brongniart, Prodrome, p. 137.
 1866. *Trigonocarpum juglans* Lesquereux. Geol. Survey of Illinois, Vol. II, p. 460, pl. 46, fig. 3.
 1870-72. *Trigonocarpus dubius* Brongniart. Schimper, Traité de Paléont. Végétale, Vol. II, p. 215.
 1879-80. *Trigonocarpus juglans* Lesquereux, Coal Flora of Penn., Vol. II, p. 588, pl. 85, fig. 4.

Original Description of *Trigonocarpum juglans* Lesquereux:

Fruit of large size, about one inch and a half in diameter, nearly round, apparently three-ribbed; ribs elevated, sulcate; surface nearly smooth, slightly striated or marked by narrow, distant lines, parallel to the ribs. Lower Coal Measures, Murphysboro, Illinois.

Discussion:

The type specimen of *Trigonocarpum juglans*, which is an incomplete fragment representing about half of the original seed, has been accurately described except for its dimensions. It was probably no more than an inch and one-eighth in greatest diameter, instead of an inch and a half as stated by Lesquereux. The specimen, so far as can be seen from its incomplete condition, closely approximates the seed described and pictured by Sternberg in 1825, both in general appearance and size. Sternberg's description is translated as: "Umbonate and striated, tri-valved, ribs elevated, very distinct."¹

Since the preserved portion of Lesquereux's specimen exhibits no characteristics that are at variance with Sternberg's specimen, there seems to be no reason to consider it as a distinct species.

Conclusion:

It is concluded that *Trigonocarpum juglans* Lesquereux does not represent a distinct species, that the name should be discarded as invalid, and that the specimen should be referred to *Trigonocarpus dubius* Sternberg.

¹ Sternberg, 1825, p. XXXV.

HOLCOSPERMUM Nathorst (1914)

(Zur Fossilen Flora der Polarländer, Teil I, Lief 4, p. 28)

HOLCOSPERMUM SULCATUM Presl

(CARPOLITHES JACKSONENSIS Lesquereux)

Plate XIX, figs. 1-2

1838. *Carpolithes sulcatus* Presl, in Sternberg, Versuch der Flora der Vorwelt, Vol. II, fasc. 8, p. 208, pl. 10, fig. 8.
1866. *Carpolithes jacksonensis* Lesquereux, Geol. Survey of Illinois, Vol. II, p. 461, pl. 46, fig. 4.
- 1879-80. *Rhabdocarpus jacksonianus* Lesquereux, Coal Flora of Penn., Vol. II, p. 576, ? pl. 85, figs. 17-19.
1917. *Holcospermum sulcatum* (Sternberg). Seward, Fossil Plants, Vol. III, p. 361, fig. 506A.

Original Description of *Carpolithes jacksonensis* Lesquereux:

Fruit about two inches long, one inch broad, ovate, oblong pointed, marked with six ? elevated ribs. This species is not rare in coal No. 1B. It may be, perhaps, referable to *Carpolithes sulcatus* Sternberg, though far different in general outline. Lower Coal Measures, Murphysboro, Illinois.

Discussion:

Two specimens of this species, one of which was figured by Lesquereux in the Illinois Survey report, were available for this study. Both are in fragmentary condition. For this reason, apparently, Lesquereux described the species as possessing only six ribs, whereas at least twice this number would be present in the complete fruit. Furthermore, the specimens do not exceed three-quarters of an inch in width, instead of an inch as stated by Lesquereux. The length was correctly given as two inches. With these proportions in mind, the specimens are referable to the form pictured and listed by Presl, but not specifically described, in Sternberg's Versuch.¹ Lesquereux's specimens are slightly larger than the one pictured in Sternberg, but agree with it in character.

In his Coal Flora of Pennsylvania, page 576, Lesquereux later transferred this species to the genus *Rhabdocarpus* Berger. According to Seward,² this genus is restricted to impressions and casts of the type *R. tunicatus* Berger; other species formerly included in this genus are now referable to *Holcospermum* Nathorst. The type *Carpolithes sulcatus* Presl is referable, on this basis, to the genus *Holcospermum*.

¹ Sternberg, 1838, p. 208, pl. 10, fig. 8.

² Seward, 1917, Vol. III, pp. 341, 362.

Conclusion:

It is concluded that *Carpolithes jacksonensis* Lesquereux does not constitute a distinct species, and should be discarded as a valid type. The specimens are consequently referred to *Holcospermum sulcatum* Presl.

CARPOLITHUS Linnaeus (1768)

(Systema Naturae, Tomus III, p. 172)

CARPOLITHUS sp.

(STIGMARIOIDES TUBEROSUS Lesquereux)

(CARPOLITHES BULLATUS Lesquereux)

Plate X, fig. 4; Plate XXIV, fig. 1

1870. *Stigmarioides tuberosus* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 453, pl. 29, fig. 5.
1870. *Carpolithes bullatus* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 463, pl. 31, figs. 22-24.
- 1879-80. *Stigmarioides tuberosus* Lesquereux, Coal Flora of Penn., Vol. I, p. 335, pl. 75, fig. 4.
- 1879-80. *Lepidocystis bullatus* Lesquereux, Coal Flora of Penn., Vol. II, p. 458, pl. 69, figs. 24-24a.
1937. *Stigmarioides tuberosus* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 22, p. 1201.

Original Description of *Stigmarioides tuberosus* Lesquereux:

I do not know any vegetable organ to which these peculiar remains could be compared. The specimen figured represents a nearly round or square oval tubercle, with a convex surface covered with small round points irregularly placed, resembling scars of hairs or scales. In its upper part it is strangulated or narrowed into a broad, tubulous, plaited leaf ? or stem ? resembling a large leaf of *Stigmaria*. It may indicate the first development of a rootstock, or represent a tubercle like those found at the end of the leaves of *Stigmaria*. It is marked in its upper part by a large round mammillate cicatrice, resembling also that of a *Stigmaria*. Its peculiar form cannot be considered as some casual deformation, as it is not only distinct in the middle of a concretion, but we have two specimens of exactly the same conformation. The one which is not figured has the leaf larger, and the tubercle slightly smaller. Mazon Creek, Illinois.

Original Description of *Carpolithes bullatus* Lesquereux:

An agglomeration of oval or round, small, wrinkled seeds, resembling vesicular spores, all nearly of the same size. They appear to have been of a soft vesicular texture. Mazon Creek, Illinois.

Discussion:

Of the two specimens of *Stigmarioides tuberosus* mentioned by Lesquereux, only the figured one was available for this study. It is a very indistinctly preserved organ, and at first glance suggests the

form of a *Ulodendron* scar. Upon close examination, it can be recognized as a flattened, macerated seed case. It may possibly be attached to a fragment of stem, or the so-called stem (or leaf) may be merely a piece of extraneous vegetable matter which became incorporated in the same nodule. Because of its poor condition, it cannot be definitely described nor assigned to any specific form.

In his Coal Flora of Pennsylvania, Lesquereux referred *Carpolithes bullatus* to a new genus established by him for the inclusion of spore cases of *Lycopodeaceae*. The limitation of this new genus, *Lepidocystis*, was admittedly vague and uncertain. The specimen here under consideration is very poorly preserved. The individual spore cases (if such they are) are indistinctly impressed in an iron-stone nodule, and very little surface character is preserved. Some of the individuals bear a vague resemblance to small forms of *Cordai-carpus* having a narrow border, or sclerotesta, but this feature is too indistinct for certainty. Other individuals certainly do not possess this character. The specimen has no value as a type, and there is no proof that the impressions belong to *Lepidocystis*.

Conclusion:

It is concluded that *Stigmarioides tuberosus* Lesquereux does not represent any form of root or tuber, and that *Carpolithes bullatus* is too vague and uncertain to be retained in the genus *Lepidocystis*. Both specimens should be discarded as valid types. They are referred to *Carpolithus* sp. which has become a convenient genus for the inclusion of seeds that do not exhibit sufficient characteristics to allow their placement in other clearly defined genera.¹

INCERTAE SEDIS

(STIGMARIOIDES SELAGO Lesquereux)

Plate XXIV, fig. 3

- 1870. *Stigmarioides selago* Lesquereux, Geol. Survey of Illinois, Vol. IV, p. 456, pl. 31, figs. 3-3b.
- 1879-80. *Rachiopteris selago* Lesquereux, Coal Flora of Penn., Vol. I, p. 332, pl. 75, fig. 8.
- 1937. *Stigmarioides selago* Lesquereux. Jongmans, Fossilium Catalogus, Vol. II, Part 22, p. 1201.

Original Description of *Stigmarioides selago* Lesquereux:

An apparently cylindrical branch or root, whose essential axis, about half an inch thick, is tapering downwards, dichotomously forking, covered with long,

¹ Seward, 1917, Vol. III, p. 497.

narrow, linear hairs or scales, bearing from the end of the divisions long, hard, quadrangular, tubular, thick, naked leaves ? with a thick, medial, vascular vein, and a narrowly striated surface. Mazon Creek, Illinois.

Discussion:

This specimen, which Lesquereux later referred to his genus *Rachiopteris*, established for fern rootlets, appears to be an agglomeration of vegetable matter associated together in the same nodule in such a way as to appear as possibly a single plant part. At one point there is part of a *Lepidophyllum*-like leaf; elsewhere the fine venation of a fern pinnule can be seen; but for the most part there is visible a mass of fine scale-like leaflets such as occurs on the rachis of some forms of *Spiropteris* and on *Asterotheca squamosa*. Scattered throughout this mass may be seen tiny spore-like objects. It is evident that the specimen does not represent a single form, but is an accumulation of partially decomposed, fragmentary, plant debris.

Conclusion:

It is concluded that *Stigmarioides selago* Lesquereux does not constitute a distinct species, and should be discarded as invalid. Since the specimen has no scientific value, and cannot be referred to any particular genus, it is relegated to *incertae sedis*.

PART II

DESCRIPTIONS OF NEW SPECIES
FROM MAZON CREEK

PART II

DESCRIPTIONS OF NEW SPECIES FROM MAZON CREEK

NEUROPTERIS Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 233)

NEUROPTERIS FLEXANTEA n. sp.

Plate XXV, fig. 2

Description:

Frond bipinnate, triangular in outline and tapering upwards from an enlarged base; pinnae linear, with alternate, oblong, very obtuse, broad, flexed, contiguous pinnules; pinnae variable in size, diminishing in size toward the apex of the frond where simple pinnules prevail; terminal leaflet of frond relatively small. Lowermost pinnae have a triangular terminal leaflet which is relatively small in proportion to the lateral leaflets of the same pinna; pinnae higher on the frond have triangular terminal leaflets which are relatively much larger than the lateral leaflets of the same pinna. Medial nerve, none; veinlets strong, and quite distinct, entering the base of the pinnules and arching towards the borders, bifurcating three to four times.

Discussion:

The specimen here under consideration is of unusual interest because it seems to combine the characteristics of *Neuropteris gigantea* Sternberg and *N. flexuosa* Sternberg. For the sake of review, Sternberg's original descriptions of these two forms are translated as follows:

Osmunda gigantea (later referred to *Neuropteris*): Frond bipinnate, pinnules cordate-oblong, obtuse, flexed, entire. Frond strong, palmate, auricular, thick, striated, pinnae alternate, pinnules opposite, 18 to 20 pairs, more generally striate.¹

Neuropteris flexuosa: Frond pinnate, pinnules lanceolate-oblong, obtuse, base cordate, rachis flexuous.²

Osmunda gigantea was first described and figured by Sternberg in 1823 in fascicle 2 of his Versuch. The type specimen represented the central or lower portion of a frond. A second specimen, consisting of a single pinna, was figured in fascicle 3, published in 1824. It

¹ Sternberg, 1823, fasc. 2, p. 33.

² Sternberg, 1825, tent., p. XVI.

was called variety *B* of *Osmunda gigantea*. Later, in the tentamen to fascicle 4, published in 1825, variety *B* was established as a distinct species under the name *Neuropteris flexuosa* Sternberg. The original *Osmunda gigantea* Sternberg was referred to the genus *Neuropteris* by Brongniart in 1828.¹ The two forms have ever since been considered as distinct species of *Neuropteris*. They are well-known forms, and have been widely reported from Carboniferous horizons in America and Europe. Specimens always consist of fragments of fronds, or usually of single pinnae.

The newly discovered specimen here under consideration represents the terminal portion of a frond. In addition to the terminal pinnules, it also shows eight succeeding uppermost pinnae arranged along one side of the rachis. The entire specimen was contained within a single, large ironstone concretion measuring approximately four by nine inches in area. Unfortunately, the lower portion of the rachis was not preserved within the concretion as recovered, but nevertheless, there can be no doubt that all of the pinnae were a part of a single frond. The uppermost pinnules and pinnae possess the characteristics of *Neuropteris flexuosa*, while the lower ones have the characters of *N. gigantea*.

The distinction between *N. gigantea* and *N. flexuosa* was originally not very clearly marked, and the original descriptions of both were rather similar. With the passing of the years, the two have come to be differentiated largely upon the character of the terminal pinnule of the respective pinnae. *Neuropteris flexuosa* has been considered as possessing a large terminal pinnule, usually much larger than the lateral pinnules of the same pinna; while *N. gigantea* has a small terminal pinnule exceeded in size by the lateral pinnules. The original type specimen of *N. gigantea* did not have the terminal pinnules preserved,² but the proportions of the pinnae indicate that they must have been relatively small. *Neuropteris flexuosa* was originally described, among other characteristics, as having a flexuous rachis. Actually, the illustration of the type specimen does not show the rachis.³ Sternberg may have inferred a flexuous rachis, however, from the appearance caused by the overlapping, cordate bases of the pinnules. Later specimens have been found in which the rachis is truly flexuous, but ordinarily the rachis is straight. Frequently an

¹ Brongniart, 1828, p. 54.

² Sternberg, 1823, pl. 22.

³ Sternberg, 1824, pl. 32, fig. 2.

optical illusion is created by the bases of the pinnules which alternately overlap the rather thick rachis in such a way as to obscure it partially, causing the visible portion to appear flexed. There seems never to have been any marked distinction between the venation of the two forms.

In the new specimen, the upper pinnae of the frond have the characteristics of *N. flexuosa*, while the lower ones have the characteristics of *N. gigantea*. This condition might present a basis for reuniting the two species of Sternberg; or it might also be interpreted as representing a distinct form intermediate between the two previously known forms. For the present, at least, the latter interpretation seems to be the more desirable.

The new specimen, therefore, is considered to be an intermediate form. It has been given the name *Neuropttris flexantea*, the specific name being derived from a combination of the first and last portions of the specific names of the previously known forms. The new species is known from a single specimen, found in the strip mine of the Mazon Creek area. The holotype has been permanently deposited in the Illinois State Museum.

NEUROPTERIS FLEXUOSA Sternberg var. INTERRUPTA n. var.

Plate XXV, fig. 1a-b

Description:

Except for the arrangement of the pinnules upon the ultimate rachis, all characters are the same as in *Neuropteris flexuosa* Sternberg. Pinnules alternate, very distant, arranged upon the rachis so that the space between each pinnule is approximately equal to the width of the pinnules, or slightly greater. Rachis heavy, striated longitudinally.

Discussion:

This variety of *Neuropteris flexuosa* Sternberg differs from the common form only in the arrangement of the pinnules upon the rachis. Instead of being close or touching, they are separated from each other by a distance which is more or less equivalent to the width of the respective pinnules. The type specimen shows only a portion of a pinna, the section thus preserved carrying six pinnules. The pinnules themselves are similar in form and venation to normally placed pinnules of the species. For purposes of record, however, those of the type variety measure two and a quarter centimeters in

length, and are one centimeter wide in the widest portion. The mid-vein is heavy, effaced above the middle, and the lateral veinlets arch widely toward the margins, bifurcating three or four times. At the margins of the pinnules the veinlets measure twenty-six to thirty per centimeter. The distance between the points of attachment of the pinnules upon the rachis is two and a half centimeters, except in one instance where this distance is only two centimeters. The variety is known from a single specimen only, found in a nodule from Mazon Creek, Illinois.

Because of the unusually distant spacing of the pinnules, this specimen is considered to be a variety of *Neuropteris flexuosa* Sternberg. It has been given the variety name, *interrupta*, which is descriptive of the interrupted placement of the pinnules upon the rachis. The holotype has been permanently deposited in the Illinois State Museum.

PECOPTERIS Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 233)

PECOPTERIS ULTRAMINUTA n. sp.

Plate XXVI

Description:

Frond tri- or quadripinnate, terminated acutely, and rapidly expanding away from the apex, full extent unknown; rachis striated and somewhat villose. Secondary pinnae alternate, with bluntly rounded, obtuse apices, at right angles or slightly oblique to rachis, linear, approximately one centimeter long and three millimeters wide near terminus of frond, rapidly increasing in size as the base of the frond is approached; largest pinnae at least eighteen centimeters long and three centimeters wide, proportions of pinnae approximately six times as long as the greatest width, rachis striated. Pinnules from a half millimeter wide by one millimeter long to one and a half centimeters long by three millimeters wide, linear, obtusely rounded at apex, sides nearly parallel, slightly wider at base, margins entire or crenulated; midrib very thick and heavy, straight, not decurrent, meeting the rachis at a slight angle, extending to apex; midvein of the small, simple pinnules continuous to apex, lateral veinlets simple, alternate, usually obscure; midvein of pinnatifid pinnules arched, bifurcating near apex, and giving rise near the base to simple lateral veinlets which also arch toward the margins. Surface of pinnules smooth. Fructification unknown.

Discussion:

The species here under consideration is unique because of the extremely small size of the simple pinnules. These individual pinnules are scarcely discernable to the naked eye, and the venation is so minute that it can be studied only under a lens. The smallest pin-

nules, near the tips of the pinnae, may be no more than a half millimeter in length, and the largest of the simple pinnules seldom exceed a millimeter in length. In form, however, they approximate the proportions of *Asterotheca lamuriana* Heer, *A. arborescens* Schlotheim, or *A. squamosa* Lesquereux. The ultimate pinnae, which bear these minute pinnules, range in length from one to three centimeters, the average length being from $1\frac{1}{2}$ to $1\frac{3}{4}$ centimeters. The greatest width of the pinnae is at the base, where it seldom exceeds three millimeters. The average number of simple pinnules along each side of the pinnae ranges from fifteen to twenty-five.

The pinnatifid pinnules are also unique in that they are unusually long in relation to their width. These range in length from one to $1\frac{3}{4}$ centimeters, the general average being about $1\frac{1}{2}$ centimeters in length. The greatest width is at the base, where it seldom exceeds three millimeters. The undulating sides are nearly parallel, tapering very slightly to the obtuse apex. The pinnules of average length carry from twelve to eighteen undulations, or lobes, along each margin. Each of these lobes carries a midvein which arches from the midrib of the pinnule, and bifurcates shortly before reaching the margin, the two forks continuing to the edge. One lateral veinlet forks off from each side of the midvein near its base, and these arch without further division to the margin of the lobe. These pinnatifid pinnules are approximately five to seven times as long as their greatest width. In this respect they are proportionate to the pinnae which carry the simple pinnules and are from five to eight times longer than their greatest width. The general form of the pinnatifid pinnules is somewhat similar to those of *Asterotheca miltoni* Artis, but the relative proportions are quite different. Those of *A. miltoni* are seldom more than three times longer than their greatest width.

This new species is known from five specimens, all being in ironstone concretions from Mazon Creek. One specimen constitutes the terminus of a frond, two are pinnatifid pinnule-bearing pinnae, and two are simple pinnule-bearing pinnae. Three specimens, one showing the frond terminus, one a complete pinna, and one a portion of a pinna, are designated as cotypes, and these have been permanently deposited in the Illinois State Museum. Paratypes remain in the private collection of George Langford, Sr., Joliet, Illinois. The new species has been named *Pecopteris ultraminuta*, the name being descriptive of the relatively small size of the individual pinnules.

PTYCHOCARPUS Weiss (1869)

(Fossile Flora Jüngsten Steinkohlenformation und Rothliegenden, Vol. 1, p. 96)

PTYCHOCARPUS UNITUS Brongniart var. UNDULATUS n. var.

Plate XXVII, figs. 1-2

1925. *Ptychocarpus unita* (Brongniart) Weiss. Noé, Illinois State Geological Survey, Bulletin No. 52, pl. 36, fig. 1.
1925. *Pecopteris unita* Brongniart. Noé, Illinois State Geological Survey, Bulletin No. 52, pl. 34, figs. 1-2; pl. 35, fig. 2.

Description:

Except for the shape of the ultimate pinnae, all characters are the same as in *Ptychocarpus (Pecopteris) unitus* Brongniart. Ultimate pinnae linear, not regularly tapering toward the apex, but undulating in width, with the widest part of the pinnae at the middle or above the middle. Base of pinnae relatively narrow, pinnae becoming still narrower within one to two centimeters above base, then gradually widening perceptibly to the widest point which is midway or beyond the mid-length of the pinnae, then again narrowing, or tapering, sharply or gradually to the apex.

Discussion:

The variety here described differs from the common form of *Ptychocarpus unitus* Brongniart only in the shape of the ultimate pinnae. Instead of the margins being generally parallel for most of their length before tapering to the apex, the pinnae of this new variety have margins which undulate in width from base to apex. One cotype (pl. 27, fig. 1) has the widest part midway between the base and the apex of the pinna, narrowing gradually from this point toward each end. The other cotype has the widest part relatively close to the apex of the pinna. When such is the case, the pinna not only narrows in each direction, but the base may be slightly wider than the narrowest position a short distance above the base (pl. 27, fig. 2). The shape of the pinnules, and the venation of all forms is the same as in the common variety.

This variety was found previously in nodules from Mazon Creek, three specimens being figured by Noé in 1925. These were not recognized as a distinct variety at that time. Since four additional specimens were recently found in the Langford collection, also from the Mazon Creek region, it now seems advisable to establish such forms as representing a distinct variety. All of the specimens are preserved in the characteristic ironstone nodules of that area. The variety name, *undulatus*, which is descriptive of the pinnae margins, is established for the inclusion of such forms. The two cotypes of

this variety have been permanently deposited in the Illinois State Museum. Paratypes are in the Langford collection. The plesiotypes figured by Noé are in the Walker Museum of the University of Chicago.

NOÉOPTERIS new genus

Fern stems having the petiole scars arranged in biserial rows; both rows on the same side of the stem; opposite side of stem without petiole scars.

Genotype: *Noéopteris asymmetrica* Janssen, hereinafter described. Coal No. 2, Pennsylvanian, Mazon Creek, Illinois.

The biserial arrangement of the scar series may indicate a possible relationship with *Megaphyton* Artis. However, the arrangement of both rows of scars on the same side of the stem, rather than on opposite sides, as in *Megaphyton*, requires the institution of a new genus. This new genus is named in honor of the late Dr. A. C. Noé, paleobotanist at the University of Chicago.

NOÉOPTERIS ASYMMETRICA n. sp.

Plate XXV, fig. 1a-b

Description:

Stem small, longitudinally wrinkled; petiole scars small, distant, arranged alternately in two longitudinal rows; both rows asymmetrically placed on one side of the stem; opposite side of stem without scars; individual scars protruding, oval, without prominent markings.

Discussion:

This species is unique in that the two longitudinal rows of scars are situated closely together on one side of the stem, as contrasted with all forms of *Megaphyton* in which the biserial rows of scars are placed on opposite sides of the stem. The species is known from a single specimen preserved in an ironstone nodule from Mazon Creek. It represents a portion of a stem six centimeters long, and two-thirds of a centimeter in width. Eight distinct, oval scars occur on this section of the stem, each measuring from four to five millimeters in length, and averaging two millimeters in width. Except for very fine, indistinct striations, the scars are featureless. The nodule containing the specimen has been split longitudinally so that each half carries a corresponding half of the preserved stem, thus exhibiting the asymmetrical nature of the scar series. While one side of the stem bears both rows of scars, the other side is featureless except for the wrinkled surface. At one end of the scarless side, however, may

be seen an accumulation of mineral matter representing internal tissue of the stem. This material is too indistinct for structural identification. The specimen may represent the stem of a very small species, or it may be merely an immature portion of a larger individual.

Even though the scar series are not on opposite sides of the stem, their biserial arrangement indicates a close relationship to the genus *Megaphyton* Artis. The new species is named *Noëopteris asymmetrica*, the name being descriptive of the scar arrangement. The holotype has been permanently deposited in the Illinois State Museum.

CAULOPTERIS Lindley & Hutton (1832)

(Fossil Flora of Great Britain, Vol. I, pl. 42)

CAULOPTERIS LANGFORDI n. sp.

Plate XXVII, figs. 3-4

Description:

Stem large, petiole scars spirally arranged, close, separated by narrow bands of rugose cortex. Individual petiole scars more or less rhomboidal in general outline, bearing near their upper portion a prominent rhomboidal-oval disk which, in turn, is marked near its upper margin by a single, punctate, vascular scar. Another larger, punctate, vascular scar occurs just below the disk, near the center of the petiole scar. Surfaces of the better preserved scars marked by scattered, verrucose costae.

Discussion:

The mode of preservation causes considerable variation in the appearance of the petiole scars of this species. Compression of the specimens may cause the scars to overlap, thus obliterating much of the scar-pattern surrounding the central disk. At first glance, such examples may present an aspect similar to that of *Lepidophloios* wherein the leaf cushions are characteristically wider than high. In this condition, the specimens resemble somewhat the species *Caulopteris tessellata* Schimper & Mougeot, from the Upper Triassic, as first pictured in their *Monographie des Plantes Fossiles*, 1844, pl. 29, and which species was later referred to the genus *Lepidodendrites* Fliche.¹

Well preserved specimens show the scars standing out prominently in a three dimensional attitude. The height and width of complete, uncompressed scars are approximately equal, these dimensions on the type specimen measuring two and a quarter centimeters in

¹ Fliche, 1906, p. 139.

each direction. The largest known scars reach three and a quarter centimeters in height and width. The third dimension, or extent to which the scars protrude from the stem surface, measures about one centimeter. The third dimension is not observable, of course, on flattened specimens.

This species is known from eight specimens, all preserved in ironstone concretions from the Mazon Creek area. One of these, the holotype (pl. 27, fig. 3) shows the scars uncompressed. Five are compressed or partially flattened specimens, and two are isolated, single scars preserved in small, individual nodules. The new species has been named *Caulopteris langfordi*, in honor of George Langford, Sr., and George Langford, Jr., of Joliet, Illinois, who collected all of the new species described herein. The holotype and one paratype have been permanently deposited in the Illinois State Museum. The other paratypes remain in the private collection of George Langford, Sr.

SIGILLARIA Brongniart (1822)

(Mémoires du Muséum d'Histoire Naturelle, Vol. VIII, p. 233)

SIGILLARIA LEIGHTONI n. sp.

Plate XXIV, fig. 4

Description:

Size of stem unknown, leaf scars uncompressed, close, separated by a distinct, narrow, undulating furrow. Individual scars somewhat orbicular in general outline, upper side slightly truncated and angular, lower side distinctly rounded, occupied near the center or slightly above the center by a central vascular pit and lateral parichnos pits. Area between the scars and furrows finely striate.

Discussion:

This species differs from the vast majority of *Sigillarias* by the extreme undulation of its furrows. The vertical series of scars are set so closely adjacent to each other that they present a distinct zig-zag arrangement in relation to each other. In this respect, they tend toward a lepidophloios condition so far as the horizontal arrangement is concerned. On the other hand, the vertical distance between each scar is relatively great and distinctly sigillarian in character. The arrangement of the scars does not correspond with any previously known species of *Sigillaria*. The specimen is unflattened by compression, and the scars protrude markedly.

The species is known from a single, but well preserved, specimen occurring in an ironstone nodule from the Mazon Creek locality. It

has been named *Sigillaria leightoni*, in honor of Dr. M. M. Leighton, present Chief of the Illinois State Geological Survey. The holotype has been permanently deposited in the Illinois State Museum.

TRIGONOCARPUS Brongniart (1828)

(Prodrome d'une Histoire des Végétaux Fossiles, p. 137)

TRIGONOCARPUS EXCRESCENS n. sp.

Plate XXVIII, figs. 3-4

Description:

Seeds probably oval, of medium size, radiospermic, surface leathery, divided longitudinally into at least three valves; valves elevated in the middle, and each marked by two prominent excrescences, or spine-like protruberances, arranged longitudinally in tandem fashion; lines of dehiscence between the valves sometimes marked by thin furrows; seeds averaging two to three centimeters in length, and individual valves about one centimeter in width at the middle.

Discussion:

This seed is characterized by the presence of two prominent tubercles, or excrescences, occurring on the central portion of each valve. These resemble, somewhat, the more numerous and irregularly scattered short spines occurring on the husk of the modern horse-chestnut fruit. In the fossil here under consideration, only two such spines occur on each valve, and these are regularly arranged in tandem style.

The species is known from two specimens occurring in ironstone nodules from Mazon Creek. Neither specimen is complete, and both have been flattened. One specimen shows three distinct valves and the other only two. The former may represent the complete fruit which has been split and flattened out into a single plane, but this cannot be certain. The complete fruit is at least tri-valved, and may possibly be six-valved. The second specimen shows the valves to be bounded by distinct margins which are expressed by conspicuous, but rather thin, furrows between them.

The presence of spine-like excrescences on this species recalls a somewhat similar condition characteristic of *Carpolithus conicus* Lindley & Hutton.¹ The latter, however, has the tubercles arranged in a single row around the convex base (?) of the fruit. Another form, illustrated by Lindley & Hutton under the name *Carpolithes*

¹ Lindley & Hutton, 1837, Vol. III, pl. 189, figs. 1-2, 4. Also Seward, 1917, Vol. III, p. 489, fig. 584.

bucklandi Williamson (ex. mss.),¹ differs from *C. conicus* only by the addition of numerous tubercles irregularly scattered over its entire surface. Seward considers these to be merely casts of insect bore holes, and unites the species with *C. conicus*. The new species here under consideration differs from *C. conicus* in not having a truncated end surrounded by tubercles, but having instead only two tubercles situated in the middle of each valve.

Because of its tri-valved nature, the new species is considered to be a representative of the genus *Trigonocarpus* Brongniart. It has been named *Trigonocarpus excrescens*, the name being descriptive of its prominent tubercles. Since each specimen shows features not present on the other one, both are designated as cotypes. These have been permanently deposited in the Illinois State Museum.

CARPOLITHUS Linnaeus (1768)

(Systema Naturae, Tomus III, p. 172)

CARPOLITHUS NOÉI n. sp.

Plate XXVIII, figs. 1-2

Description:

Seeds probably oval, of medium size, radiospermic (?); surface smooth and leathery, marked by prominent longitudinal ridges bearing single rows of numerous, small spines or tubercles; area between the ridges deeply indented into a single, longitudinal depression. Seeds about two centimeters in length, ridges three-quarters of a centimeter apart at widest point.

Discussion:

This species, like *Trigonocarpus excrescens* Janssen and *Carpolithus conicus* Lindley & Hutton, is marked by prominent, but much smaller, spines, or tubercles. It is more closely related to the former, since the spines occupy single, longitudinal rows. The species is known from a single specimen found in an ironstone nodule from Mazon Creek. The specimen does not exhibit any differentiation into valves, and hence cannot be referred definitely to the genus *Trigonocarpus* Brongniart. It shows two ridges, and is only a portion, or one side, of a complete fruit. The depressed area between the ridges may not be a true characteristic of the species, but may represent merely a collapsed condition prior to fossilization.

Since this new species exhibits no definite generic characteristics, it is tentatively placed in the genus *Carpolithus* Linnaeus which is

¹ Lindley & Hutton, 1837, Vol. III, pl. 189, figs. 3, 5.

a genus reserved for seeds of uncertain affinity. The new species is named *Carpolithus noéi* in honor of the late Professor A. C. Noé, paleobotanist at the University of Chicago. The holotype has been permanently deposited in the Illinois State Museum.

INCERTAE SEDIS

SCHOPFIA new genus

Structures of polygonal outline, trapezoidal or irregularly rounded. Relatively large. Affinity unknown.

Genotype: *Schopfia deueli* Janssen, hereinafter described. Coal No. 2, Pennsylvanian, Mazon Creek, Illinois.

It is here proposed to institute a new genus for the inclusion of structures quite unlike any heretofore described. These structures are polygonal in outline, some being four-sided, some five-sided, and others somewhat irregularly rounded. The sides are unequal, thereby giving the structures a trapezoidal outline. They may possibly be tuberous appendages, although their general appearance and surface texture is more suggestive of seed cases. Definite proof as to their possible affinity is lacking. For this reason, it seems advisable to institute a new genus for their reception. This new genus is named in honor of Dr. J. M. Schopf of the Illinois State Geological Survey.

SCHOPFIA DEUELI n. sp.

Plate XXVIII, figs. 5-6

1879-80. (?) *Stigmara* (tuberous appendage), Lesquereux, Coal Flora of Penn., Vol. II, p. 513, pl. 74, fig. 12 (non fig. 13).

Description:

Seed cases (?) medium to large in size, platyspermic (?) irregularly shaped, with four or five unequal sides, or subangularly ovoid; surface leathery and somewhat wrinkled; detached or connected to a longitudinally striated stem. Greatest diameter measuring from three and one-half to six centimeters.

Discussion:

This species is characterized by its lack of symmetry, possessing an outline that may be described as an irregular pentagon, or a trapezoid. A specimen which may possibly belong to the same species, but which has a more rounded shape, was pictured by Lesquereux in his Coal Flora of Pennsylvania, plate 74, figure 12. Although

considered by him to be an appendage of *Stigmara* Brongniart, it does not appear to be comparable to the so-called *Stigmara* tuber pictured by Corda,¹ and which was the basis upon which Lesquereux identified his specimen.

The species bears no characteristics which would suggest its being a tuber, nor which would link it with *Stigmara*. It seems, rather, to be a very large form of seed case with a surface texture resembling that of *Lepidocystis* Lesquereux. It is probably too large to belong to the latter genus, since its size would imply a strobile of enormous proportions, exceeding by far any hitherto known.

The species is known by two specimens found in ironstone concretions from the Mazon Creek area, exclusive of the specimen figured by Lesquereux which is questionably referred to this species. Because of its uncertain affinity, the species is referred to the new genus *Schopfia* Janssen. It has been named *Schopfia deueli* in honor of Dr. Thorne Deuel, present Chief of the Illinois State Museum. The holotype and paratype have been permanently deposited in the Illinois State Museum.

SCHOPFIA CALCEOLA n. sp.

Plate XXVIII, fig. 7

Description:

Seed cases (?) relatively large, more or less triangular or slipper-like in outline, platyspermic (?), with two gently curving sides terminating in an acute apex (?), third side shorter and nearly straight; surface leathery and somewhat wrinkled. Greatest diameter measuring four to four and a half centimeters, width one and one-half to two centimeters at widest point.

Discussion:

This species is characterized by a shape which is rather slipper-like in general aspect. The "toe" of the "slipper" is sharply pointed, from whence the sides widen considerably as they extend onward to a blunt "heel" at the opposite end. The species appears to be related somewhat to *Schopfia deueli* Janssen, but lacks the angular sides of the latter form. The leathery surface is somewhat wrinkled, due probably to partial collapse before being fossilized. In life, the structure may have been smooth.

The species is known from three specimens preserved in ironstone nodules from Mazon Creek. It is referred to the genus

¹ Corda, 1867, p. 33, pl. 12, fig. 1.

Schopfia Janssen since no characters are present which would definitely place it in other clearly defined genera. The species has been named *Schopfia calceola*, the name being descriptive of its slipper-like shape. The holotype has been permanently deposited in the Illinois State Museum, and the paratypes are in the Langford collection.

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PLATES

PLATE I

- Fig. 1 *Annularia stellata* Martin. Type specimen of *Annularia inflata* Lesquereux. I S M No. 1685. (x 1).
- Fig. 2 (a) *Diplothmema zobeli* Goepfert. Type specimen of *Hymenophyllites splendens* Lesquereux.
(b) *Sphenophyllum cornutum* Lesquereux. Type specimen. I S M No. 1630. (x 1).
- Fig. 3 *Lepidodendron wortheni* Lesquereux. Obverse side of type specimen. I S M No. 1730. (x 1).
- Fig. 4 *Lepidodendron wortheni* Lesquereux. Reverse side of type specimen. I S M No. 1730. (x 1).

* I S M=Illinois State Museum.

PLATE I



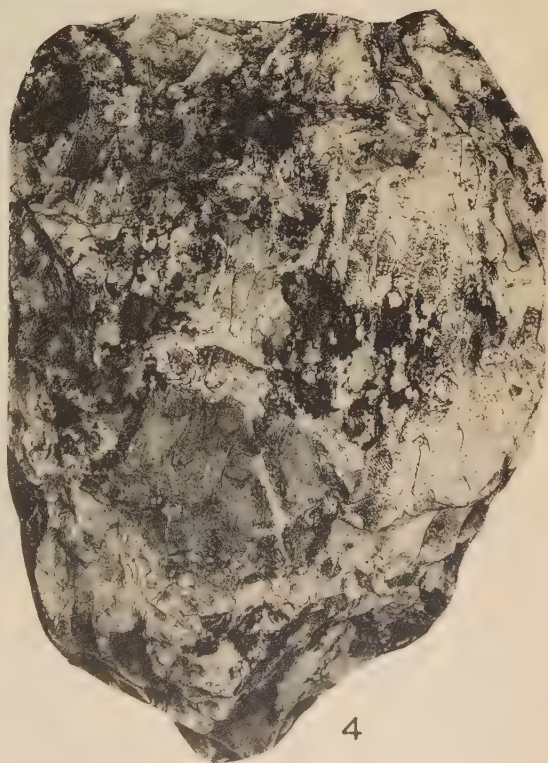
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PLATE II

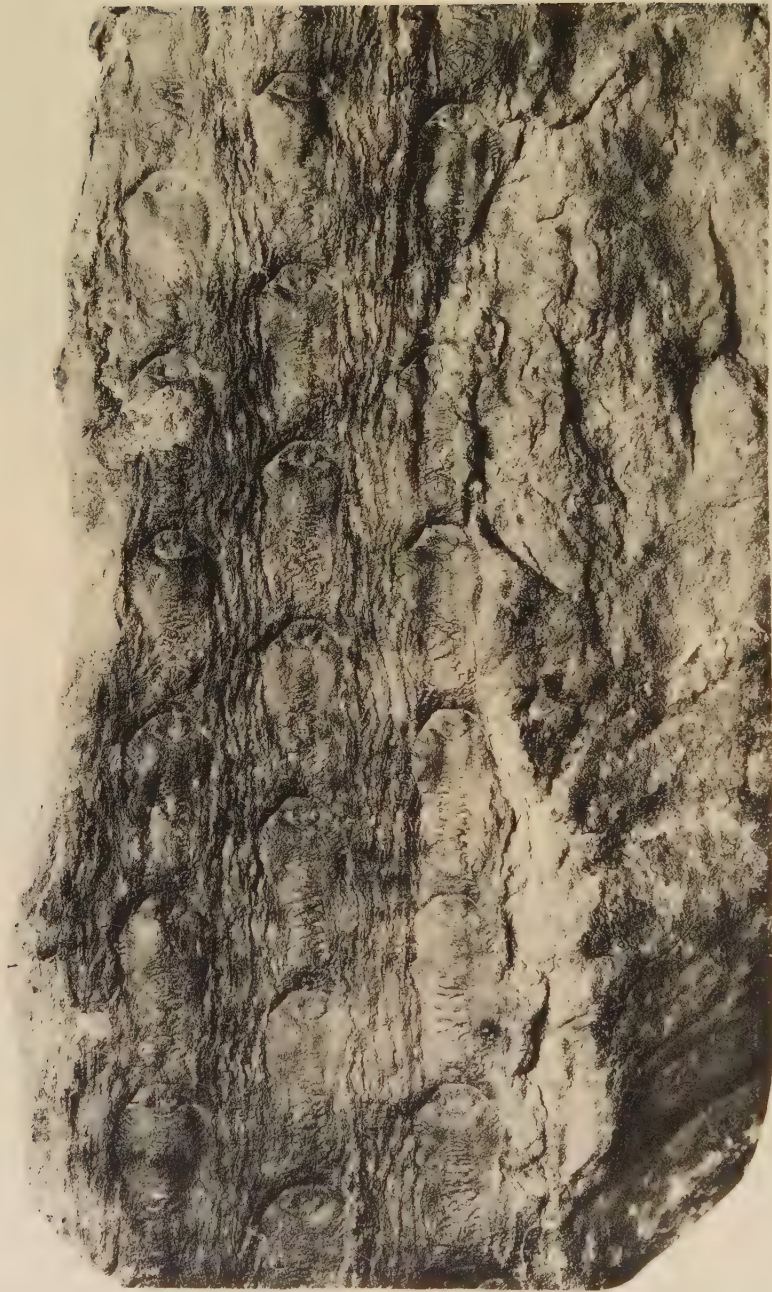


PLATE II

Lepidodendron volkmannianum Sternberg. Type specimen of *Lepidodendron costatum* Lesquereux. I S M No. 8682. (x 1).

PLATE III

- Fig. 1 *Lepidodendron volkmannianum* Sternberg. Type specimen of *Lepidophloios protuberans* Lesquereux. I S M No. 1745. (x 1).
- Fig. 2 *Lepidodendron rimosum* Sternberg. Type specimen of *Lepidodendron tijoui* Lesquereux. I S M No. 1727. (x 1).
- Fig. 3 *Lepidophloios laricinus* Sternberg. Type specimen of *Lepidophloios obcordatum* Lesquereux. I S M No. 1728. (x 1).
- Fig. 4 *Lepidodendron* sp. Type specimen of *Lycopodites annulariaefolius* Lesquereux. I S M No. 1663. (x 1).

PLATE III



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PLATE IV



PLATE IV

Lepidodendron rimosum Sternberg. Type specimen of *Ulodendron elongatum* Lesquereux. I S M No. 8679. (x 1).

PLATE V

- Fig. 1 *Asolanus camptotaenia* Wood. Type specimen of *Sigillaria monostigma* Lesquereux. I S M No. 1725. (x 1).
- Fig. 2 *Asolanus camptotaenia* Wood. Type specimen of *Sigillaria monostigma* Lesquereux. I S M No. 1790. (x 1).
- Fig. 3 *Asolanus camptotaenia* Wood. Type specimen of *Sigillarioides stellaris* Lesquereux. I S M No. 1737. (x 1).

PLATE V



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PLATE VI

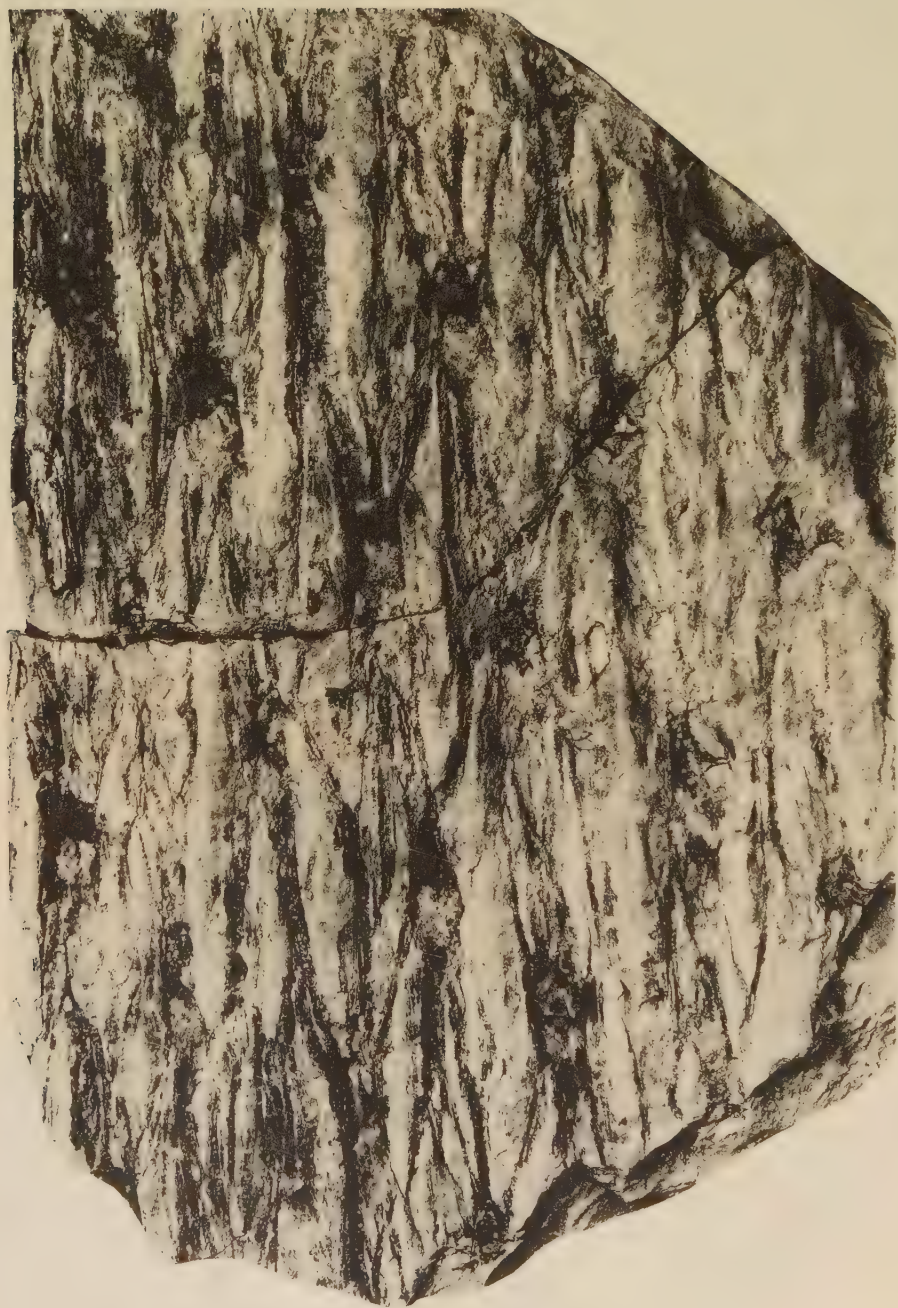


PLATE VI

Asolanus camptotaenia Wood. Type specimen of *Lepidodendron cruciatum* Lesquereux. I S M No. 1744. (x 1).

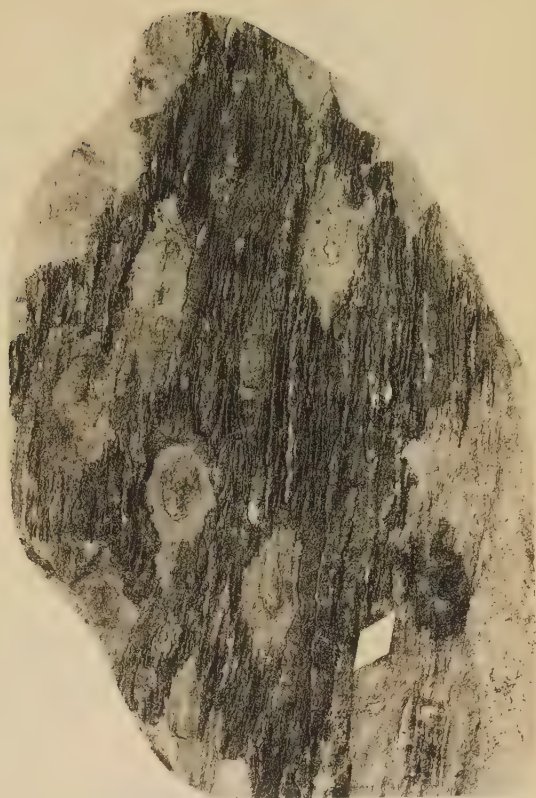
PLATE VII

- Fig. 1 *Bergeria* sp. Type specimen of *Sigillaria corrugata* Lesquereux. I S M No. 1740. (x 1).
- Fig. 2 *Bergeria* sp. Type specimen of *Sigillaria corrugata* Lesquereux. I S M No. 1740a. (x 1).
- Fig. 3 *Bergeria* sp. Type specimen of *Lepidodendron forulatum* Lesquereux. I S M No. 1759. (x 1).
- Fig. 4 *Bergeria* sp. Type specimen of *Lepidodendron obscurum* Lesquereux. I S M No. 1749. (x 1).

PLATE VII



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PLATE VIII



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PLATE VIII

- Fig. 1 *Bothrodendron* sp. Type specimen of *Sigillarioides radicans* Lesquereux. I S M No. 8690. (x 1).
- Fig. 2 *Stigmarioides truncatus* Lesquereux. I S M No. 8688. (x 1).
- Fig. 3 *Stigmaria ficoides* Sternberg. Type specimen of *Stigmaria elliptica* Lesquereux. I S M No. 1706. (x 1).
- Fig. 4 *Stigmarioides linearis* Lesquereux. I S M No. 8687. (x 1).

PLATE IX

- Fig. 1 *Lepidostrobus oblongifolius* Lesquereux. I S M No. 1622.
(x 1).
- Fig. 2 *Lepidostrobus lancifolius* Lesquereux. I S M No. 1666.
(x 1).
- Fig. 3 *Lepidostrobus variabilis* Lindley & Hutton. Type specimen
of *Lepidostrobus connivens* Lesquereux. I S M No. 1646.
(x 1).
- Fig. 4 *Lepidostrobus variabilis* Lindley & Hutton. Type specimen
of *Lepidostrobus truncatus* Lesquereux. I S M No. 1673.
(x 1).
- Fig. 5 *Lepidostrobus ovatifolius* Lesquereux. I S M No. 1623.
(x 1).

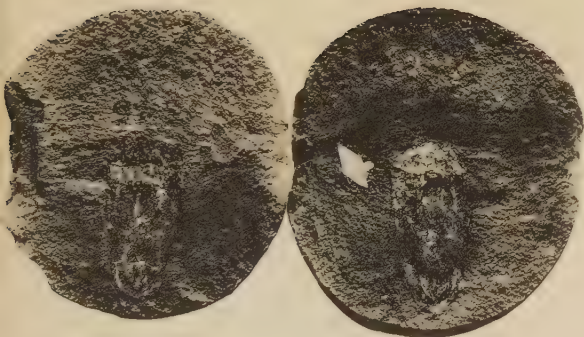
PLATE IX



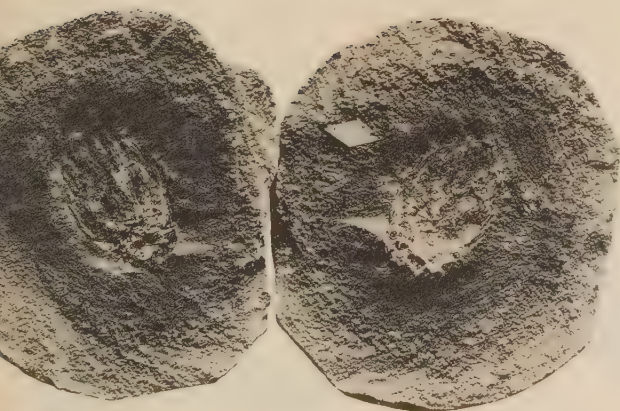
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PLATE X



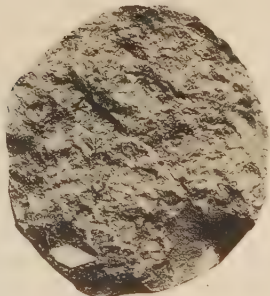
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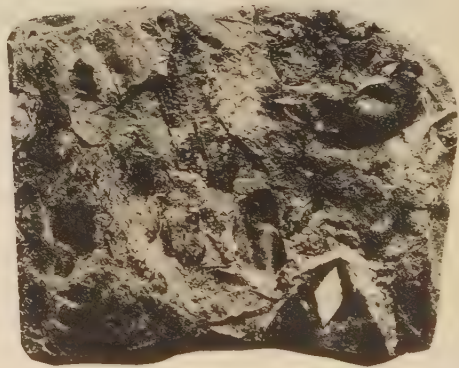
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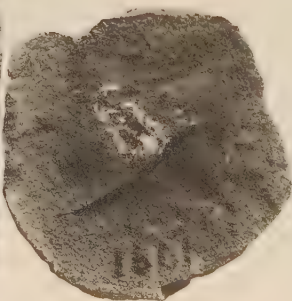
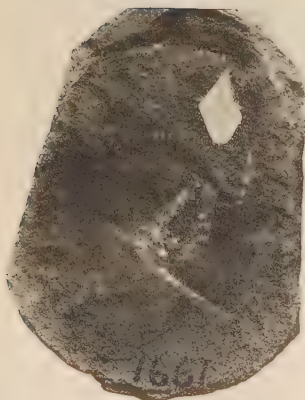
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PLATE X

- Fig. 1 *Lepidostrobophyllum majus* Brongniart. Type specimen of *Lepidophyllum auriculatum* Lesquereux. I S M No. 1780. (x 1).
- Fig. 2 *Lepidostrobophyllum majus* Brongniart. Type specimen of *Lepidophyllum striatum* Lesquereux. I S M No. 1664. (x 1).
- Fig. 3 *Lepidostrobophyllum majus* Brongniart. Type specimen of *Lepidophyllum rostellatum* Lesquereux. I S M No. 1640. (x 1).
- Fig. 4 *Carpolithus* sp. Type specimen of *Carpolithes bullatus* Lesquereux. I S M No. 1645. (x 1).
- Fig. 5 *Lepidocystis vesicularis* Lesquereux. Type specimen of *Carpolithes vesicularis* Lesquereux. I S M No. 1644. (x 1).
- Fig. 6 *Lepidocarbon corticosum* (Lesquereux) Schopf. Type specimen of *Carpolithes corticosus* Lesquereux. I S M No. 1661. (x 1).
- Fig. 7 *Lepidocystis vesicularis* Lesquereux. Type specimen of *Carpolithes vesicularis* Lesquereux. I S M No. 1621. (x 1).

PLATE X *bis*

- Fig. 1 *Lepidocarpon corticosum* (Lesquereux) Schopf. Right half of holotype. I S M No. 1661. Slightly enlarged, scale indicated.
- Fig. 2 Same as above, left half of holotype.
- Fig. 3 (a) *Lepidocarpon corticosum* (Lesquereux) Schopf. Topotype specimen showing seed megaspore and general aspect. Illinois State Geological Survey No. SB9b. Slightly enlarged, scale indicated.
(b) Same specimen, somewhat greater magnification, scale indicated. Seed megaspore has been removed. Note character of lamina and broad midrib.
- Fig. 4 Same as above, seed structure and megaspore shown at higher magnification, scale indicated. Note deep cast of pedicel and attachment to axial splinter.

(Photographs by Illinois State Geological Survey)

PLATE X *bis*

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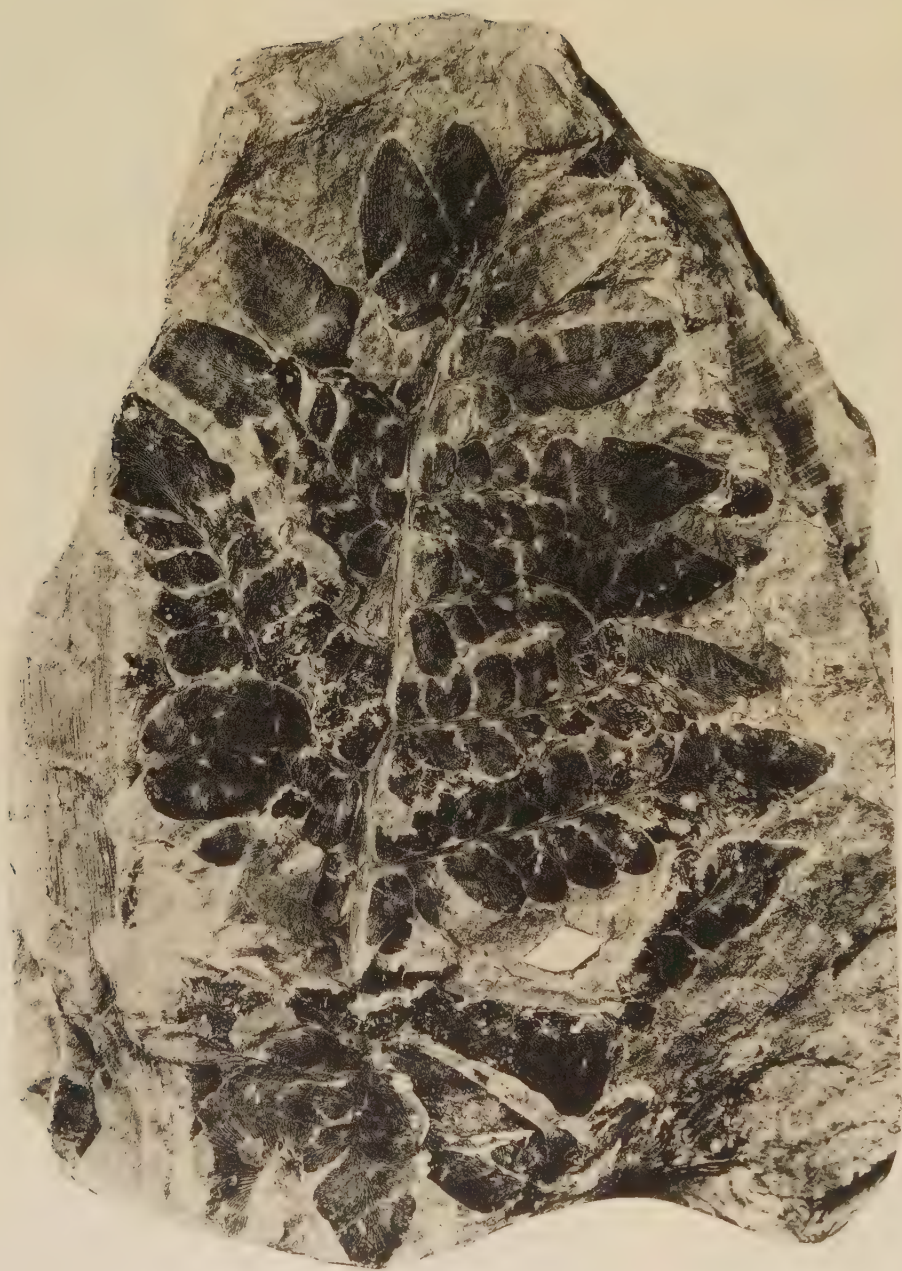


PLATE XI

Neuropteris heterophylla Brongniart. Type specimen of *Neuropteris capitata* Lesquereux. I S M No. 1624. (x 1).

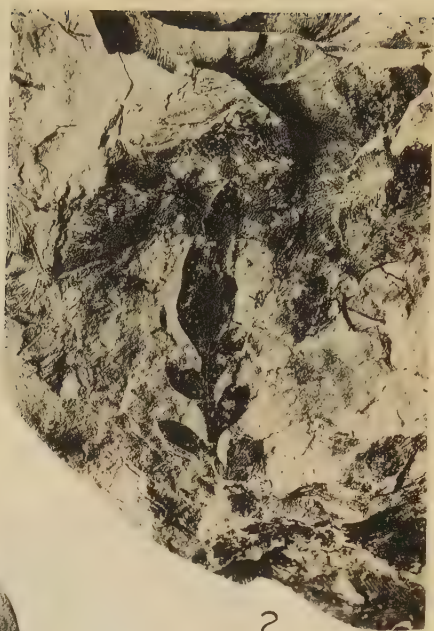
PLATE XII

- Fig. 1 *Odontopteris subcuneata* Bunbury. Type specimen of *Odontopteris heterophylla* Lesquereux. I S M No. 1786. (x 1).
- Fig. 2 *Odontopteris subcuneata* Bunbury. Type specimen of *Odontopteris heterophylla* Lesquereux. I S M No. 1786a. (x 1).
- Fig. 3 *Cyclopteris collinsi* Lesquereux. Type specimen of *Neuropteris collinsii* Lesquereux. I S M No. 1647. (x 1).
- Fig. 4 *Odontopteris subcuneata* Bunbury. Type specimen of *Odontopteris heterophylla* Lesquereux. I S M No. 1785. (x 1).
- Fig. 5 *Odontopteris subcuneata* Bunbury. Type specimen of *Odontopteris heterophylla* Lesquereux. I S M No. 1786b. (x 1).

PLATE XII



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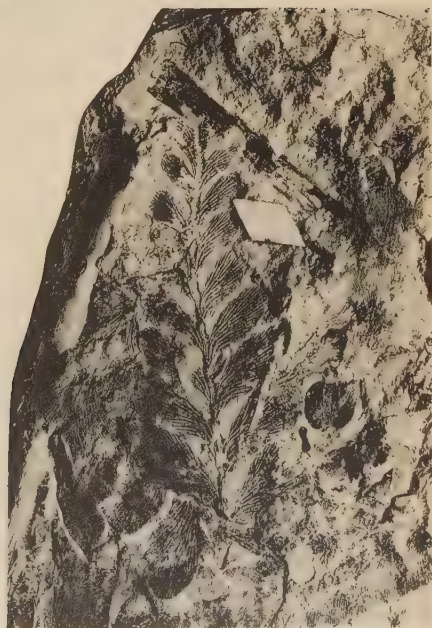
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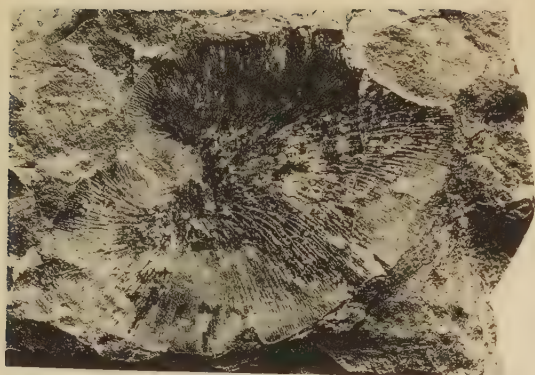


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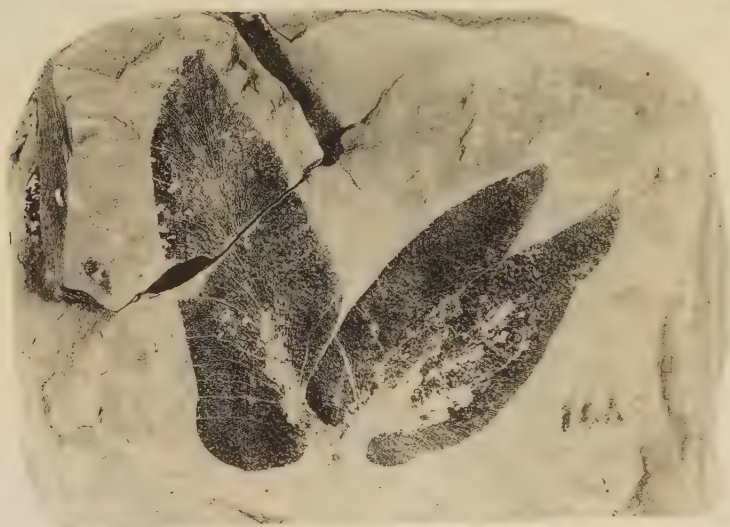
PLATE XIII



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PLATE XIII

- Fig. 1 *Linopteris münsteri* Eichwald. Type specimen of *Dictyopteris rubella* Lesquereux. I S M No. 1677. (x 1).
- Fig. 2 *Neuropteris scheuchzeri* Hoffmann. Type specimen of *Neuropteris fasciculata* Lesquereux. I S M No. 1668. (x 1).
- Fig. 3 *Neuropteris scheuchzeri* Hoffmann. Type specimen of *Neuropteris fasciculata* Lesquereux. I S M No. 1668a. (x 1).
- Fig. 4 *Sphenopteris mixta* Schimper. Type specimen; originally referred by Lesquereux to *Sphenopteris rigida* Brongniart. I S M No. 1731. (x 1).
- Fig. 5 *Sphenopteris illinoisensis* D. White. Type specimen of *Alethopteris hymenophylloides* Lesquereux (pars). I S M No. 1753. (x 1).

PLATE XIV

- Fig. 1 *Mariopteris mazoniana* Lesquereux. Type specimen of *Alethopteris mazoniana* Lesquereux. I S M No. 1625. (x 1).
- Fig. 2 *Mariopteris mazoniana* Lesquereux. Type specimen of *Alethopteris mazoniana* Lesquereux. I S M No. 1625a. (x 1).
- Fig. 3 *Mariopteris mazoniana* Lesquereux. Type specimen of *Alethopteris mazoniana* Lesquereux. I S M No. 1625b. (x 1).
- Fig. 4 *Mariopteris mazoniana* Lesquereux. Type specimen of *Alethopteris mazoniana* Lesquereux. I S M No. 1625c. (x 1).

PLATE XIV



PLATE XV



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PLATE XV

- Fig. 1 *Alethopteris* sp. Type specimen of *Alethopteris inflata* Lesquereux. I S M No. 1675. (x 1).
- Fig. 2 *Asterotheca miltoni* Artis. Type specimen of *Sphenopteris paupercula* Lesquereux. I S M No. 1784. (x 1).
- Fig. 3 *Desmopteris* sp. Type specimen of *Alethopteris falcata* Lesquereux. I S M No. 8634. (x 1).
- Fig. 4 *Desmopteris* sp. Type specimen of *Alethopteris solida* Lesquereux. I S M No. 1678. (x 1).

PLATE XVI

- Fig. 1 *Asterotheca squamosa* Lesquereux. Type specimen of *Pecopteris squamosa* Lesquereux. I S M No. 1628. (x 1).
- Fig. 2 *Asterotheca squamosa* Lesquereux. Type specimen of *Pecopteris squamosa* Lesquereux. I S M No. 1628a. (x 1).
- Fig. 3 *Asterotheca squamosa* Lesquereux. Type specimen of *Pecopteris squamosa* Lesquereux. I S M No. 1628b. (x 1).



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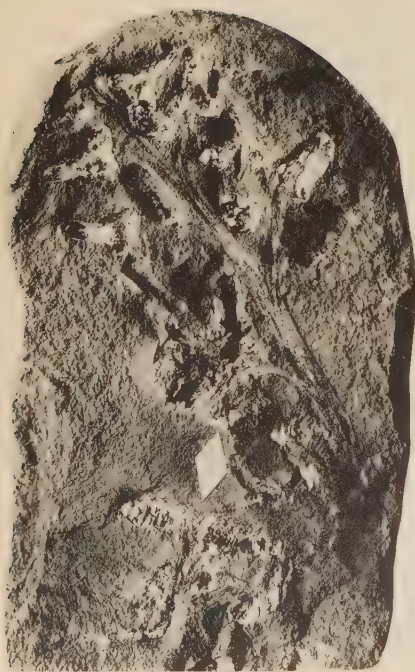


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PLATE XVII



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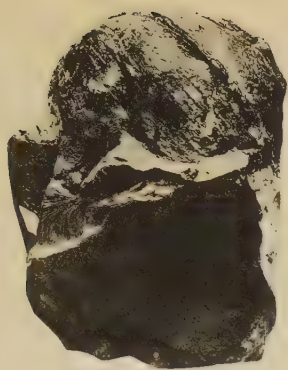
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- Fig. 1 *Callipteris* sp. Type specimen of *Alethopteris hymenophylloides* Lesquereux (pars). I S M No. 1753. (x 1).
- Fig. 2 *Crossothea sagittata* Lesquereux. Type specimen of *Staphylopteris sagittatus* Lesquereux. I S M No. 1754. (x 1).
- Fig. 3 *Spiropteris uncinata* Lesquereux. Type specimen of *Selaginites uncinatus* Lesquereux. I S M No. 1726. (x 1).

PLATE XVIII

- Fig. 1 *Trigonocarpus dubius* Sternberg. Type specimen of *Trigonocarpum juglans* Lesquereux. I S M No. 1729. (x 1).
- Fig. 2 *Trigonocarpus parkinsoni* Brongniart. Type specimen of *Trigonocarpum rostellatum* Lesquereux. I S M No. 1781. (x 1).
- Fig. 3 *Sorocladus wortheni* Lesquereux. Type specimen of *Staphylopteris wortheni* Lesquereux. I S M No. 1655. (x 1).
- Fig. 4 *Caulopteris wortheni* Lesquereux. I S M No. 1747. (x ½).

PLATE XVIII



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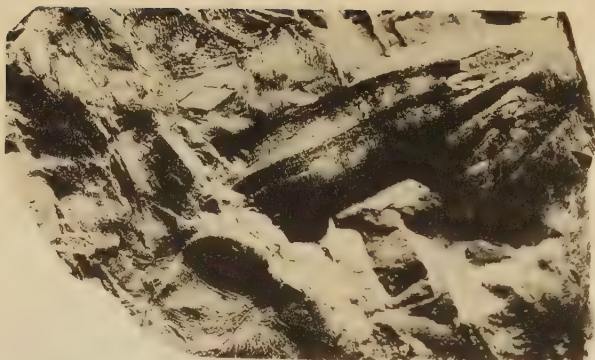


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PLATE XIX



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PLATE XIX

- Fig. 1 *Holcospermum sulcatum* Presl. Type specimen of *Carpolithes jacksonensis* Lesquereux. I S M No. 1648. (x 1).
- Fig. 2 *Holcospermum sulcatum* Presl. Paratype specimen of *Carpolithes jacksonensis* Lesquereux. I S M No. 1648a. (x 1).
- Fig. 3 *Megaphyton frondosum* Artis. Type specimen of *Megaphytum protuberans* Lesquereux. I S M No. 1632. (x 5/12).

PLATE XX

Megaphyton approximatum Lindley & Hutton. Type specimen of
Megaphytum McLayi Lesquereux. I S M No. 1782. (x 1).

PLATE XX



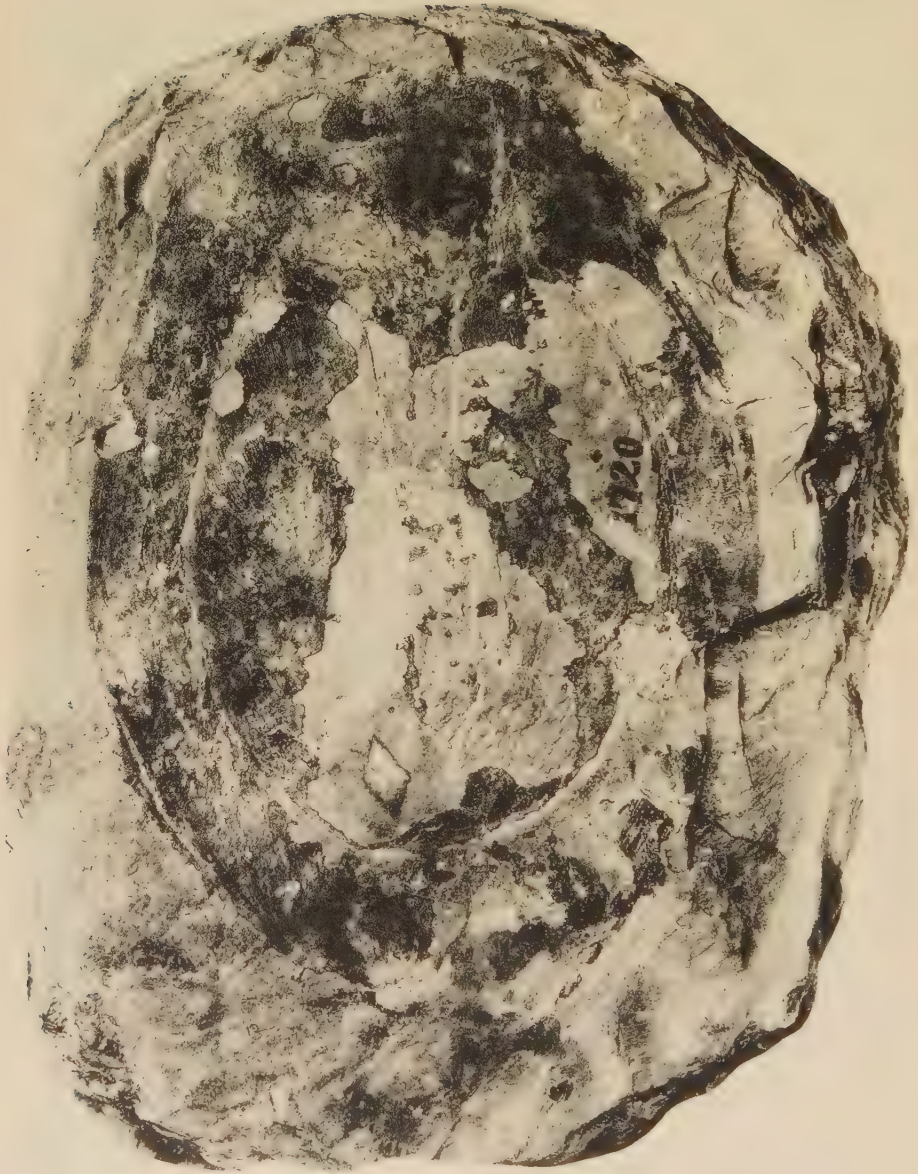


PLATE XXI

Megaphyton insignis Lesquereux. Type specimen of *Caulopteris insignis* Lesquereux. I S M No. 1720. (x 1).

PLATE XXII

Caulopteris radicans Lesquereux. Type specimen of *Lepidodendron radicans* Lesquereux. I S M No. 1721. (x 1).

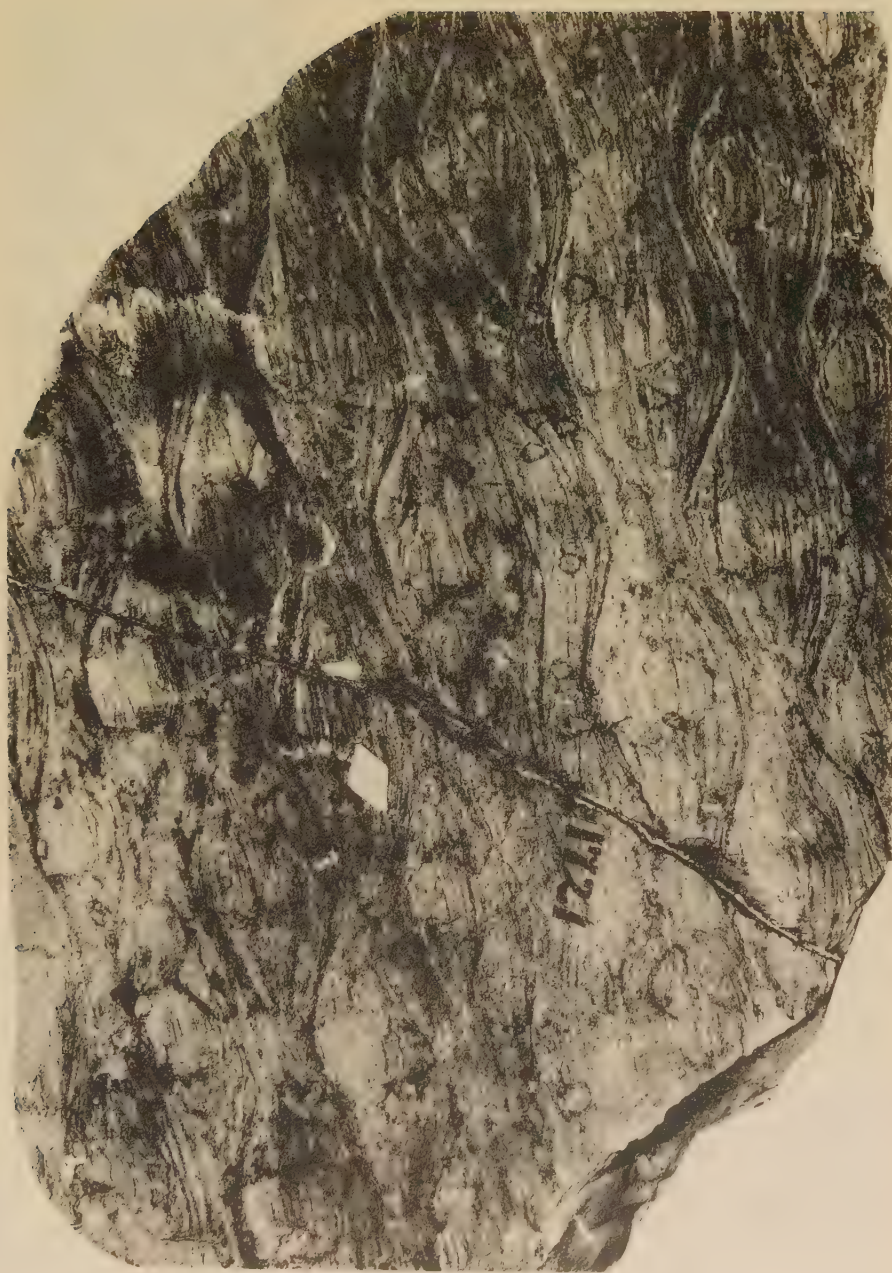




PLATE XXIII

Caulopteris sp. Type specimen of *Caulopteris acantophora* Lesquereux. I S M No. 1670. (x 1).

PLATE XXIV

- Fig. 1 *Carpolithus* sp. Type specimen of *Stigmarioides tuberosus* Lesquereux. I S M No. 1665. (x 1).
- Fig. 2 *Caulopteris* sp. Type specimen of *Caulopteris acantophora* Lesquereux. I S M No. 1670a. (x 1).
- Fig. 3 *Incertae sedis*. Type specimen of *Stigmarioides selago* Lesquereux. I S M No. 8695. (x 1).
- Fig. 4 *Sigillaria leightoni* n. sp. Holotype. I S M No. 14763. (x 1).



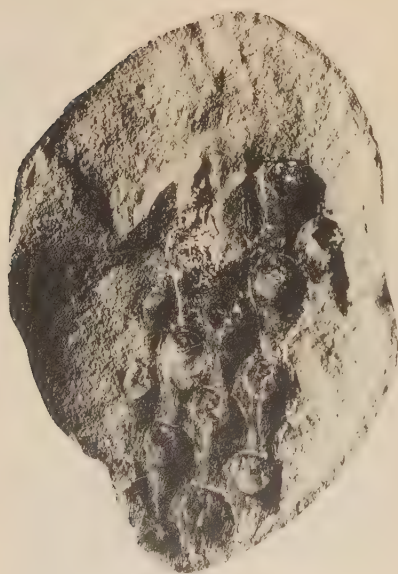
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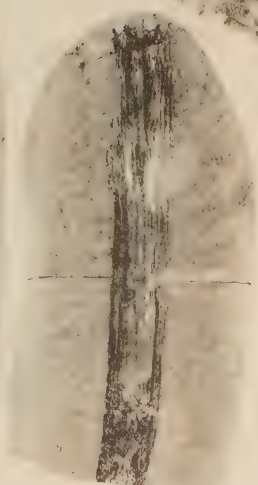
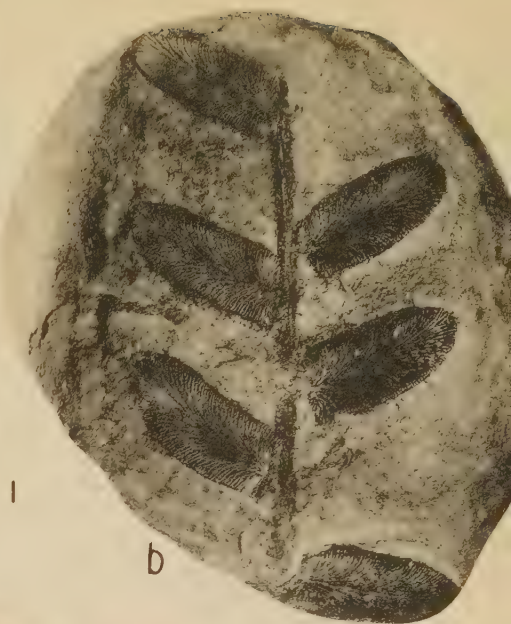
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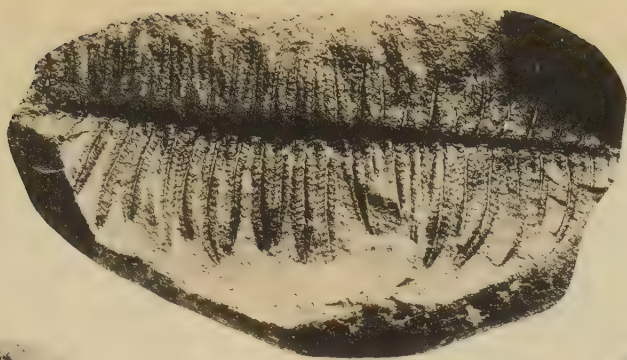
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PLATE XXV

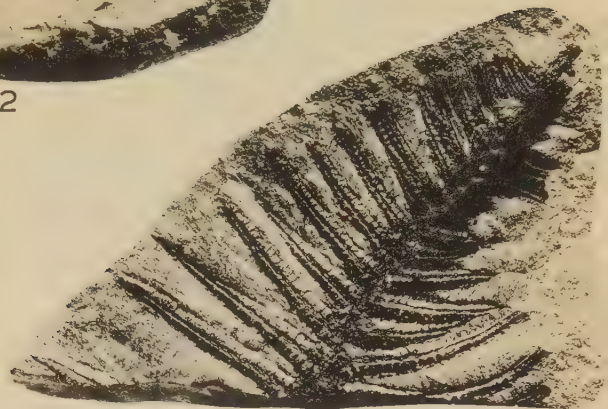
- Fig. 1 *Neuropteris flexuosa* Sternberg var. *interrupta* n. var. Holotype. (a) Positive side of impression. (b) Negative side of impression. I S M No. 14754. (x 1).
- Fig. 2 *Neuropteris flexantea* n. sp. Holotype. I S M No. 14458. (x $\frac{3}{4}$).
- Fig. 3 *Noéopteris asymmetrica* n. sp. Holotype. (a) Side of stem showing biserial rows of scars. (b) Side of stem without scars. I S M No. 14760. (x 1).

PLATE XXVI

- Fig. 1 *Pecopteris ultraminuta* n. sp. Cotype showing terminus of frond. I S M No. 14755 (x 1).
- Fig. 2 *Pecopteris ultraminuta* n. sp. Cotype showing pinna with simple pinnules. I S M No. 14756. (x 1).
- Fig. 3 *Pecopteris ultraminuta* n. sp. Cotype showing pinna with pinnatifid pinnules. I S M No. 14757. (x 1).
- Fig. 4 *Pecopteris ultraminuta* n. sp. Detail of pinnules. (x 4).



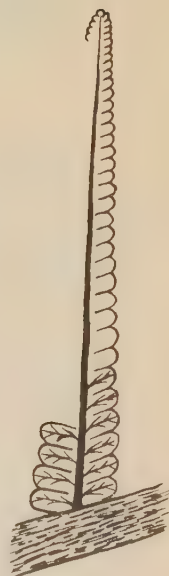
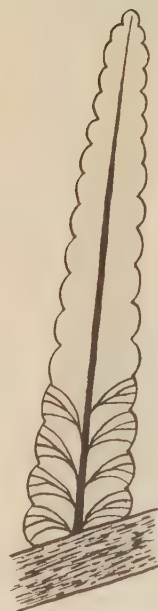
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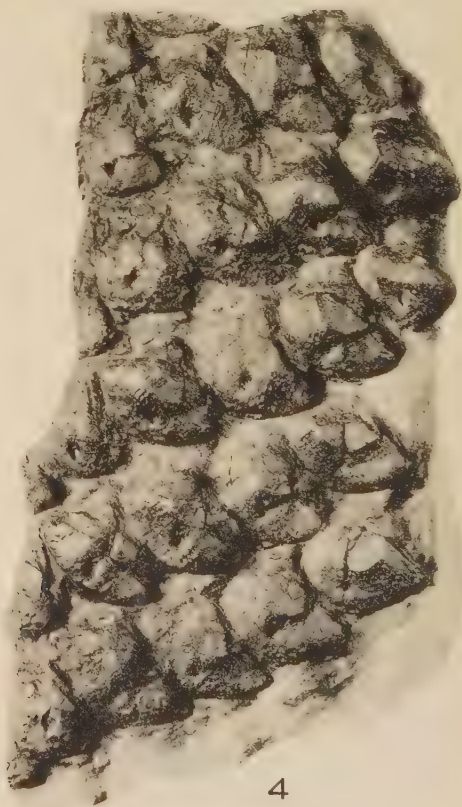
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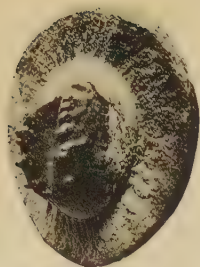
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- Fig. 1 *Ptychocarpus unitus* Brongniart var. *undulatus* n. var.
Cotype showing widest portion of pinna near middle. I
S M No. 14758. (x 1).
- Fig. 2 *Ptychocarpus unitus* Brongniart var. *undulatus* n. var.
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- Fig. 3 *Caulopteris langfordi* n. sp. Holotype. I S M No. 14761.
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- Fig. 4 *Caulopteris langfordi* n. sp. Paratype. I S M No. 14762.
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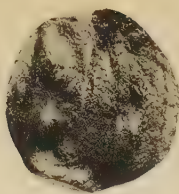
PLATE XXVIII

- Fig. 1 *Carpolithus noéi* n. sp. Front view of holotype. I S M No. 14766. (x 1).
- Fig. 2 *Carpolithus noéi* n. sp. Side view of holotype. I S M No. 14766. (x 1).
- Fig. 3 *Trigonocarpus excrescens* n. sp. Cotype showing two valves preserved. I S M No. 14764. (x 1).
- Fig. 4 *Trigonocarpus excrescens* n. sp. Cotype showing three valves preserved. I S M No. 14765. (x 1).
- Fig. 5 *Schopfia deueli* n. sp. Holotype. I S M No. 14767. (x 1).
- Fig. 6 *Schopfia deueli* n. sp. Paratype. I S M No. 14768. (x 1).
- Fig. 7 *Schopfia calceola* n. sp. Holotype. I S M No. 14769. (x 1).

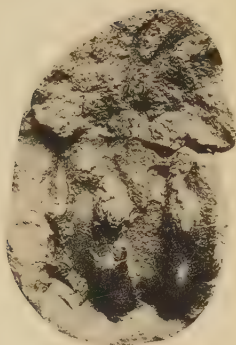
PLATE XXVIII



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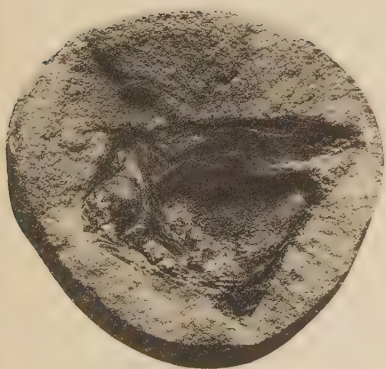
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